

AD-A063 139 WOODWARD-CLYDE CONSULTANTS PLYMOUTH MEETING PA
NATIONAL DAM INSPECTION PROGRAM. STILL CREEK DAM (NATIONAL I.D.--ETC(U)
JUN 78 J H FREDERICK, W S GARDNER

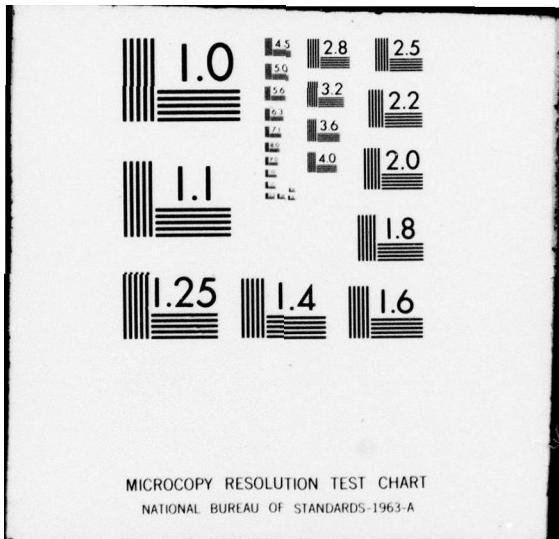
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John H. /Frederick, Jr.
William S. /Gardner

National Dam Inspection Program. Still
Creek Dam (National I.D. Number PA-00700),
Schuylkill River Basin, Still Creek,
Schuylkill County, Pennsylvania. Phase I
Inspection Report,

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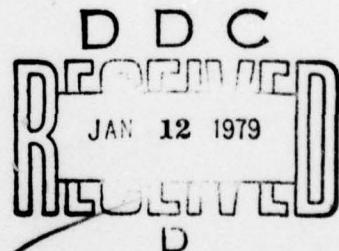
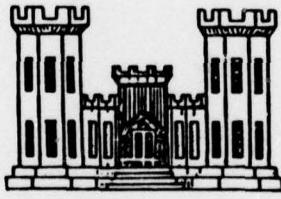
LEVEL IV

(1)

SCHUYLKILL RIVER BASIN

STILL CREEK DAM
SCHUYLKILL COUNTY, PENNSYLVANIA
NATIONAL I.D. NO. PA 00700

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



Prepared by:

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Submitted to:

DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

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June 1978

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PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

Name of Dam: Still Creek Dam

County Located: Schuylkill County

State Located: Pennsylvania

Stream: Still Creek

Coordinates: Latitude 40° 51.4' Longitude 75° 59.4'

Date of Inspection: 10 May 1978

(cont'd p 1) ————— The dam

Still Creek Dam appears to be in relatively good condition. Although some seeps were noted in the downstream area, the seeps are not turbid and show no evidence of soil erosion. No sloughing, displacements or seepage were noted on the crest or face of the dam or at the natural abutments.

Evaluation of watershed data from nearby Bear Creek together with the available design information indicates the spillway is capable of passing a flood similar to the Probable Maximum Flood. Therefore, the spillway is considered to be "Adequate".

A few items of normal maintenance should be performed to improve the overall functioning of the dam. These include regrading of the crest to remove ponded water; removal of vegetation from the spillway chute and repair of deteriorated concrete at the spillway crest. The thrust braces on the valves in the Valve House should be evaluated and repaired as necessary. Downstream seepage should be monitored at critical locations and evaluated annually by an Engineer.

A resident superintendent lives on the property year-round and is charged with reporting the development of abnormal conditions. This daily surveillance should significantly reduce the probability of an undetected malfunction of the dam.

>A formal warning system should also be developed for use in the event of impending abnormally high flows downstream. The maintenance procedure should also be formally documented and implemented.

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6/20/78
Date

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Date

APPROVED BY:

G. R. Withers

G. R. WITHERS
Colonel, Corps of Engineers
District Engineer

10 Jul 78

Date

OVERVIEW
STILL CREEK DAM, SCHUYLKILL COUNTY, PENNSYLVANIA



PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
STILL CREEK DAM
NATIONAL ID #PA 00700

SECTION 1
PROJECT INFORMATION

1.1 General.

a. Authority. The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

b. Purpose. The purpose of the inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project.

a. Dam and Appurtenances. Still Creek Dam is a zoned rolled earth embankment with riprap facing approximately 1,076 feet long and 86 feet high at the original streambed. The dam was designed with a central core of impervious fill materials extending down to the rock surface. A reinforced concrete spillway for overflow discharge is located at the right abutment. There is a 20-inch blow-off and a 36-inch water supply pipe which connect the intake tower with the pump-house, as shown on Plate 3. An inspection of the blow-off pipe in the Valve House reveals a 36-inch diameter pipe, although 20-inch diameter pipe is noted by the design data. These emergency discharge and water supply pipes are controlled by gate valves at the Valve House located at the downstream toe. Sluice gates and trash racks are operated at the intake tower.

b. Location. The dam is located on Still Creek approximately 2600 feet east of Route 29 near the intersection of Route 309 at Still Creek, Schuylkill County, Pennsylvania.

The dam site and reservoir is shown on USGS Quadrangle, Tamaqua, Pennsylvania, at coordinates N 40° 51.4', W 75° 59.4'. A Regional Location Plan of Still Creek Dam and Reservoir is enclosed as Plate 1, Appendix E.

c. Size Classification. Intermediate (height is 86 feet and reservoir is 1182.5 acre-feet).

d. Hazard Classification. High Hazard classification because residential dwellings are located in the downstream valley and at the community of Still Creek on Route 309.

e. Ownership. Tamaqua Borough Authority. Operated by the Borough of Tamaqua.

f. Purpose of Dam. Water supply for Tamaqua and adjacent communities.

g. Design and Construction History. Still Creek Dam was designed for the Panther Valley Water Company (original Owner) by Gannett, Seelye and Fleming Engineers, Inc., Harrisburg, Pennsylvania, in the late 1920's and early 1930's, in accordance with the provisions of the construction permits. Three construction permits were issued to: (1) begin construction; (2) raise the dam to an intermediate height (59 feet high); and (3) to complete the dam to a height of 86 feet. While under the ownership of the Panther Valley Water Company, repairs were made as follows:

Removal of trees and brush from embankment

Repair of left abutment spillway

Repair sections of spillway crest and concrete floor of channel.

All work was performed in 1962 and 1963 and approved by the Division of Dams and Encroachments, Department of Forests and Waters, Harrisburg, Pennsylvania.

h. Normal Operation Procedure. Water is supplied to the users at a rate of approximately 2 million gallons per day to the Borough residents and 3-1/2 to 4 million gallons per day to, primarily, the coal industry. Excess water is channeled over the emergency spillway and is discharged into Still Creek approximately 800 feet downstream of the spillway crest. The owner reports that the blow-off (drain) valve is exercised once a year to check the system. It is understood that the dam operation consists of leaving the sluice gates and water supply discharge valve open such that the discharge from the reservoir to the Borough is regulated by the demands of the distribution system. The water is treated by demand at the Valve House. The water supply and drawdown pipes are buried in the embankment between the Intake Tower and Valve House.

1.3 Pertinent Data

a.	Drainage Area (sq. miles)	6.9
b.	Discharge at Dam Site (cfs)	
	Max. Known Flood at Dam Site	500 (May 1946, Mar. 1951,
	Max. Design Flood at Dam Site	6200 and Oct. 1955)
	Water Supply Outlet Works at Peak Demand (1-36")	No Rating Curve
	Blow-Off Valve (1-20")	No Rating Curve
	Spillway at Max. Pool Elev.	9700
	Max. Non-Damaging Discharge	7500 (est.)
c.	Elevations (feet above MSL)	
	Top of Dam	1192
	Normal Pool (Spillway Crest)	1182.3
	Maximum Pool	1192
	Maximum Pool of Record	0.9 (above spillway crest)
	Water Supply - High Intake	1145.0
	- Low Intake	1125.5
	Water Supply Exit	Pipeline
	Blow-Off Intake	1100.0
	Blow-Off Exit @ Stilling Basin	1096.6
	Blow-Off Exit Channel	1105.2
	Foot Bridge	1190
d.	Reservoir (miles)	
	Length at Normal Pool	2.5
	Fetch at Normal Pool	1.6
e.	Storage (acre-feet)	
	Normal Pool (Spillway Crest)	8287 acre-feet
	Top of Dam	11,587 acre-feet
f.	Reservoir Surface (acres)	
	Normal Pool (Spillway Crest)	332

g. Dam Data

Type	Rolled Earth with clay core with 25 feet high concrete cut-off wall
Length	1160 feet
Height - Streambed to Dam Crest	86 feet
- Foundation to Dam Crest	101 feet
Top Width	30 feet
Side Slopes - Upstream	2 $\frac{1}{2}$ H:1V
- Downstream above El. 1150	2.2H:1V
- Downstream below El. 1150	2 $\frac{1}{2}$ H:1V
Zoning	Rolled Earth both sides of clay core with riprap slopes.
Grout Curtain	None.

h. Diversion and Regulation Tunnel

Type: Water Supply

Blow-Off

1-36" from Tower to Valve House

1-36" to City

1-20" from Tower to Valve House (1)

1-48" from Valve House to Stilling Basin

102 feet wide Ogee Spillway Crest.

All valves are located in Valve House

Only to Valves in Valve House. All pipes buried under Dam. All pipes are under full reservoir head and controlled by 30" gate valves with invert at 1097.6 feet.

Spillway

Closure

Access

Regulatory Facilities

i. Spillway

Type

Concrete Ogee Crest

Length

102 feet

Elevation

1180 feet

Upstream Channel

+2% - 102 feet wide,

Downstream Channel

260 feet long

-1% - 102 feet wide,

100 feet long to a

-6% - 210 feet long

to streambed.

(1) This size is doubtful. Visual inspection indicates a 36" pipe through wall of Valve House.

SECTION 2
ENGINEERING DATA

2.1 Design.

a. Data Available. A summary of engineering data on Still Creek is presented in the checklist attached as Appendix A. Engineering design data available for Still Creek Dam was contained primarily in a 15-sheet set of blueprints dated between 1924 and 1933. A set of these drawings is in the current Owner's possession and at the Commonwealth of Pennsylvania, Department of Environmental Resources, main office in Harrisburg, Pennsylvania. It is noted that these are design drawings and that several changes to the structures were noted in colored pencil on the copies in the Harrisburg office. The visual inspection confirmed several of these changes. Additional data was obtained from the files of the Department of Environmental Resources in Harrisburg, Pennsylvania.

Principal documents containing pertinent data are:

1. Letter concerning "Geologic Survey" by George A. Ashley, State Geologist to Gannett, Seelye and Fleming, dated January 20, 1925.
2. A series of progress reports, File 54-111, fall through the winter of 1928.
3. Fifteen construction photographs dated 1928 (3), 1932 (5), 1934 (6) and 1935 (1).
4. Forty-eight 3-1/2" by 6" construction photographs dated 1930 through 1962 (excellent quality detailing construction).
5. Application for construction of dam dated September 26, 1924 and Application Approval dated March 10, 1925.
6. Construction Specifications by Gannett, Seelye and Fleming Engineers, Inc., dated April 1924. Details of the embankment materials were not presented in the specifications.

7. Report Upon the Request of the Panther Valley Water Company, dated October 11, 1927.
8. Report Upon the Request of the Panther Valley Water Company, dated November 19, 1930.
9. Report Upon the Request of the Panther Valley Water Company, dated March 10, 1932.
10. Report Upon the Request of the Panther Valley Water Company, dated June 24, 1932
11. Miscellaneous memoranda, letters and visual inspection reports.

Contained in this data are references to, but no documentation of the properties of embankment materials, engineering analysis of embankment stability and design criteria. The construction specifications briefly described the type of embankment materials but did not go into any detail as to material properties or required degree of compaction.

b. Design Features. The principal design features of Still Creek Dam are illustrated on the Plan, Profile and Cross-Section that are enclosed in Appendix E as Plate 2 through 6. These plates are reproduced from the 15 design drawings, prepared by Gannett, Seelye and Fleming Engineers, Inc. The drawings show that the dam was constructed in two stages (Elevation 1163 and Elevation 1190) being completed in 1932 and 1935, respectively. The drawings show the embankment having a maximum height of 86 feet from the streambed to the crest.

The dam contains a central clay core over a 25-foot concrete cut-off wall founded on rock. Photographs of the core wall document foundation bearing levels at various areas. Design drawings indicate rolled earth upstream and downstream of the clay core but photographs show a coarser "dirty" fill upstream along the outer section of the dam. Records indicate that random soils were apparently used on the downstream side. However, there was no description as to the type or properties of these materials.

Section 1.3 shows that the exterior slopes changed at two locations on both sides of the dam. This slope change was observed on the downstream side.

A reinforced concrete spillway with masonry protected channel walls was designed and constructed to the right of the dam. Photographs document this construction feature. Traces of the previous temporary spillway were observed downstream of the dam confirming the intermediate construction. The hydraulic parameters of the spillway are discussed in Section 5 below. Water flows down the channel and discharges over a water fall (See Photo 5 of Appendix D) and into a short channel which empties into the original Still Creek.

2.2 Construction.

Available data pertaining to the construction history of this structure was scattered in various documents and pieced together as follows.

1. Construction apparently began in the late 1920's and the intermediate dam height at Elevation 1163 was completed in 1932. The overflow side channel was located at elevation 1153 in the area of Station 9 + 00 through 10 + 00.
2. The final construction began in late 1932 and the dam was completed to elevation 1190 by 1935. The top width was increased from a design dimension of 20 feet to 30 feet. To achieve this 10 ft. width increase, the downstream slope was steepened from elevation 1150 to the top of the dam.
3. Visual inspection of the dam revealed that several feet of granular fill (2 to 3 feet) were added to the crest which narrowed the roadway to approximately 22 feet. This apparently accounts for the present crest elevation of 1192+.

2.3 Operation Data.

Water supply flow to the Borough is monitored by a Simplex Model MOL recorder which will be replaced by a Fisher Porter Model 50MF2212ABCBB recorder in the near future. The distribution system demand controls the out flow.

There were no records available documenting when and how the 20-inch blow pipe is operated. Reservoir levels are recorded daily and were available from the present to 1962.

2.4 Evaluation.

a. Availability. All engineering data reproduced in this report and studied for this investigation were provided by the Pennsylvania Department of Environmental Resources. The Owner's representative was readily available to provide information about the construction and operation of the dam.

b. Adequacy. Due to the limited amount of detailed engineering data available, the final assessments of this investigation must be based primarily on the visual inspection, verbal reports of the dam operation, and the approximate hydraulic analyses performed as part of this investigation.

c. Validity. Design drawings show the proposed borrow source and quarry location for the embankment. Records infer their use but do not directly confirm the location of borrow sources. There were no records available documenting in-place or approval type testing of any materials used in the construction. Based on the visual inspection, construction photographs and design drawings together with the hand-written changes, it is concluded that the dam and appurtenances were most likely constructed in accordance with the specifications (Section 2.1 a.6) and noted changes.

SECTION 3
VISUAL INSPECTION

3.1 Findings.

a. General. The observations and comments of the field inspection team are contained in the checklist enclosed herein as Appendix B and are summarized and evaluated as follows. In general, the appearance of the facility indicated that the dam and its appurtenances were properly constructed and are well maintained.

b. Dam. During the visual survey, there were no indications or evidence observed of distortions in alignment or grade that would be indicative of movement of the embankment or foundation. A careful inspection of the dam disclosed seepage as described in detail in Appendix B, page 5a and 5b.

It was observed that approximately two feet of granular fill, apparently road base material, was placed on the dam subsequent to the original construction. Severe degradation of the shale type riprap was observed along the exposed upstream slope and on the entire downstream slope. It is believed that this deterioration will not adversely affect the performance of the structure.

c. Appurtenant Structures. At the time of the inspection water was barely flowing over the spillway (see Photo 2, Appendix D). Some spalling was observed on the crest and along the spillway weir. Previous repair work noted in Section 1.2 g was observed. The upper end of the discharge channel (riprap portion) downstream of the crest was noted to be in fair condition and will require rehabilitation to prevent further deterioration. The concrete lined channel beginning 100 feet from the crest is severely spalled and broken at the end. This section will require repair. The masonry side channel walls were observed to be in fair to good condition with vegetation growing between the rock. Vegetation (small trees) were noted in the channel confirming that flow down the channel was rare and usually low allowing this vegetation to develop.

The control tower was found to be in good condition, and all valves were exercised except the blow-off valve. The foot bridge was found to be in fair to good condition. As noted on Photo 1, Appendix D, the supporting

pier was tilted most probably from ice pressure. The Owner indicated that this feature was inspected by divers during the underwater rehabilitation work performed on the tower in the Fall of 1976.

The Valve House was inspected and noted that the thrust bars on the 30-inch valve were completely deteriorated. Although not part of this inspection, it was noted that the chimney in the pumphouse is cracked and deteriorating. A discussion of the chimney is described in Appendix B, Sheet 7 of 11, under Outlet Structures.

Since the water supply and blow-off pipes are encased in concrete and buried under the embankment, they could not be inspected. It is shown on Plate 6, Appendix E, that the 36-inch water supply pipe has a venturi gage section in the Valve House. This feature was not located, but assumed to be buried just outside the Valve House where venturi tubes lead through the wall.

d. Reservoir. Reconnaissance of the reservoir disclosed no evidence of siltation, slope instability, or other features that would significantly affect the flood storage capacity of the reservoir.

e. Downstream Channel. With the exception of the waterfall zone between the end of the spillway and the base of the waterfall (approximately 50 feet), the channel appears to be stable down to the community of Still Creek on Route 309. The valley between the dam and Still Creek contains several homes and property which constitutes High Hazard conditions.

3.2 Evaluation.

The survey of the dam disclosed no evidence of apparent past or present movement to indicate instability of the dam embankment. The seeps observed at the downstream toe of the dam do not appear to be associated with potential piping as evidenced by the clear water observed. The absence of documented past observations or flow records gives no baseline for judgement of changes in this seepage with time.

The degree of spalling of the spillway crest and channel is typical of a dam with over 40 years of service. The conditions observed within the discharge channel do not appear to represent an immediate hazard to the integrity of the dam.

The noted severe deterioration of the thrust rods on both the water supply and blow-off valves appears to have had no adverse affect on the performance of the system. However, it is noted that these valves probably never experienced high stress emergency drawdown conditions as may be associated with low frequency high flow storms. Under these conditions, the system may be inadequate in the present condition and should be evaluated. If the evaluation reveals an unacceptable condition, the braces should be replaced. Similarly, the chimney should be re-evaluated and repaired as necessary.

SECTION 4 OPERATION PROCEDURES

4.1 Procedures.

The maximum reservoir level is regulated by discharge over the spillway with a crest elevation of 1182.3. Water for public consumption use is drawn-off through a 36-inch pipe with the flow apparently regulated by the demands of the distribution system removed from the dam. Shut-off valves for the pipe are located in the Valve House. A 20-inch diameter blow-off line parallels the water system pipe from the intake tower to the Valve House. As shown on Plate 6, these pipes are interconnected by a common valve. It is reported that the blow-off is exercised at least once a year. It is understood from the Owner's representative that no written procedures exist for the Operation of the Still Creek Dam.

4.2 Maintenance of Dam.

The dam is reportedly maintained by the Owner's personnel who periodically check the structures and perform minor repairs.

4.3 Maintenance of Operating Facilities.

The valve control mechanisms and in the Valve House, the sluice gates in the intake tower and the bridge to the intake tower are clean, painted and lubricated as needed to insure proper operation and indicate periodic maintenance. As indicated in previous sections and in Appendix B, thrust braces for the valves in the Valve House are completely deteriorated and should be replaced pending further evaluation. Similarly, the chimney should be evaluated and repaired as necessary.

4.4 Warning Systems in Effect.

There are no formal warning systems or procedures established to be followed during periods of exceedingly heavy rainfall. A caretaker lives at the toe of the dam and inspects the structure on a regular basis. The caretaker is also aware of the proper authorities to contact in the event that a hazardous condition develops.

4.5 Evaluation.

It is believed that the current operating procedures are a reasonably realistic means of operating the relatively simple control facilities of Still Creek Dam. A formal warning procedure to be implemented during periods of extreme rainfall should be formulated so that residents downstream could be amply warned of possible high volumes of flow in Still Creek. Repairs indicated during this inspection include the valve saddle thrust braces and the chimney.

SECTION 5
HYDROLOGY/HYDRAULICS

5.1 Evaluation of Features.

a. Design/Evaluation Data. Original readily available design data were limited to statements located in the State files, particularly in the Application Report dated January 7, 1925. In 1966 the Soil Conservation Service designed and constructed the Little Schuylkill flood control dam two miles downstream of Still Creek on the Little Schuylkill River. The design drainage area for the Little Schuylkill Dam was 15.6 square miles including the area above Still Creek.

(1) The original drainage area as listed in the Application Report was 8.5 sq. miles based on a 1889 topographic (USGS) survey. The latest USGS maps indicated a drainage area of 6.9 sq. miles with the probability that strip mining modified the topography and reduced the drainage area. The current drainage area is long and narrow, being approximately 3.8 miles long and 1.4 to 2.4 miles wide, elevations range from 1760 in the upper reaches to approximately 1182 at the reservoir. The watershed is 70 to 80 percent wooded and sparsely populated. It is not expected to experience rapid growth in the near future.

A 30-inch pipe diverts water from the adjacent Quakake Creek drainage basin into the upper end of Still Creek Reservoir. This flow is judged to have an insignificant affect on the PMF.

It is noted that an SCS flood routing through Still Creek Reservoir entitled "Design Storm Routing" was also reviewed in conjunction with the SCS data developed for the Little Schuylkill Dam. This storm (6 hrs., 12.3 inches rainfall; 11.2 inches runoff; and 8.7 sq. mile drainage) was determined to have a peak inflow of 16,650 cfs, peak outflow of 7,700 cfs and a maximum reservoir water level of 1190± feet. It is noted here that the 8.7 square miles used by SCS in the hydrograph development cannot be supported by current USGS maps.

(2) Original spillway capacity calculations for Still Creek rated the spillway capable of passing 6200 cfs with a head of seven feet. Originally, the final spillway elevation was to be 1180. Later, it was decided to raise the spillway crest by the use of a 30-inch ogee weir. Because of an error in the survey, the final weir elevation was reported to be 1182 feet. This additional weir height increased the normal storage and reservoir surface area.

(3) The evaluation of Still Creek Reservoir and spillway performed by the Soil Conservation Service for the investigation of Little Schuylkill Dam rated the spillway capacity as 6900 cfs with a seven-foot head (a 700 cfs difference from the original capacity). The SCS rating curve shows that Still Creek spillway has a maximum capacity with no freeboard to be approximately 9700 cfs. The spillway crest elevation was surveyed to be 1182.3 feet. Investigation of the downstream Little Schuylkill flood control dam required routing of the PMF by SCS criteria through Still Creek Reservoir in order to determine the inflow for Little Schuylkill Dam.

(4) In accordance with the criteria established by the Federal (OCE) Guidelines, the recommended spillway design flood for this intermediate size dam and high hazard potential classification is the probable maximum flood.

b. Experience Data. Reservoir water surface elevations are measured daily and records maintained in the Valve Control Building. The water levels are measured at the weir, assumed elevation 1182 feet. Rainfall records are also maintained at the Valve House and sent to the Weather Service. The maximum recorded water level is 1182.9 (500 cfs) measured in March 1951; October 1955 and May 1946. Tropical Storm Agnes, June 1972, with a 24-hour rainfall of 5.28 inches recorded at the dam, produced eight inches of water over the weir, a flow of 400 cfs.

c. Visual Observations. On the date of the inspection, no conditions were observed that would indicate that the outlet capacity would be significantly reduced during a flood occurrence. Observations regarding the downstream channel, spillway condition and reservoir are located in Appendix B.

d. Overtopping Potential. The SCS developed an inflow PMF hydrograph from a six-hour storm which produced 20.91 inches of runoff and a peak inflow of 30,500 cfs for Still Creek Watershed. This flow is judged to be over-conservative, based on a review of the available data and regional experience. It is noted that the SCS procedure tends to produce high peak inflows for small watersheds. It is also noted that the drainage area (8.7 sq. miles) used by SCS in the hydrograph development cannot be supported by current USGS maps. However, it is assumed that the weir crest and top of dam elevations, stage-storage and stage discharge curves as developed by the SCS study are correct. It is further assumed that the SCS stage discharge curve was developed by computing the backwater curve from the crest of the overflow, up the spillway to the reservoir. The SCS routing indicates the structure will be overtapped during an extreme event. The calculations developing the inflow hydrograph are not readily available, being stored in SCS archives in Mechanicsburg, Pennsylvania and could not be retrieved and analyzed before this report was prepared.

By combining the peak PMF inflow as determined by the prescribed OCE criteria (Appendix C) with the relevant SCS hydrologic data, the spillway is found to be adequate to pass the PMF without overtapping.

e. Spillway Adequacy.

(1) The spillway capacity of 9700 cfs (at the top of the dam) and available flood water storage enable the structure to safely discharge the PMF (with an estimated peak inflow of 10,482 cfs) without overtapping; therefore, the spillway is "Adequate". The tailwater is estimated to be 90 feet or more below the top of the dam during passing of the PMF.

(2) According to SCS evaluations, there are no homes upstream of the Little Schuylkill Dam that are subject to flooding during design high water as shown on the construction drawings. According to the SCS investigations, the design high water from downstream Little Schuylkill Dam is estimated to come up to the Valve Control Building. There also appears to be no homes subject to flooding during passing of the PMF through Still Creek and/or Little Schuylkill Reservoirs. However, if Still Creek Dam were to fail and produce a flood wave, a potential for loss of life exists to the community of Still Creek at Route 309 and possible severe damage to Little Schuylkill Dam. Since this potential exists, Still Creek Dam is classified as a High Hazard Dam.

SECTION 6 STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations. The visual observations did not indicate any existing embankment stability problems. Small seeps were observed however, at several locations downstream and near the toe of the dam. The clarity of the seepage water indicates that piping or erosion within the dam is not occurring. However, the lack of records of past seepage observations give no basis for judging whether changes have or have not occurred. A detailed discussion is enclosed in Appendix B on Pages 5a and 5b.

The visual inspection of the spillway did not reveal any evidence of instability at the ogee weir. However, some cracking at the end of the concrete lined channel was observed as shown by Photo 2. Spalling was common throughout the channel and repair patches were observed at the weir and along the channel.

The intake tower was observed to be in good condition together with the foot bridge. It is noted that the central tower support for the bridge is tilted, reportedly as a result of ice during the past several winters. A couple of years ago an aeration system was installed to reduce odor and has also prevented ice from forming around the tower and bridge pier.

b. Design and Construction Data. Since there is no evidence that any formal stability or seepage analyses were ever made for this dam, the evaluation of the structural stability can be based only on a review of the design drawings. The visual inspection and past performance indicates that the dam is presently stable. Although there are no direct records, inferences in the documentation indicate that the borrow source and quarry sites noted in the design documents were used during construction. Photographs of construction tend to confirm that proper placement and zoning was performed.

With the exception of the missing venturi gage section in the 36-inch water supply pipe located on Plate 6, all other water supply features were apparently constructed in accordance with the plans. Photos show that railroad tracks were used as reinforcement and anchored in the bedrock.

c. Operating Records. There is no evidence that any stability problems have occurred during the operational history of the dam. It was noted that the facility withstood the recent flood of tropical storm Agnes in 1972 and several past floods which produced more run-off than Agnes.

d. Post-Construction Changes. There were no reports nor is there any evidence that modifications or alterations were made to the dam except for the additional fill on the crest and the discrepancy in the spillway elevation. This discrepancy is discussed in Section 5. The staged construction of the dam was performed as designed in accordance with the application permit.

e. Seismic Stability. This dam is located in Seismic Zone 1. Normally, it can be considered that if a dam in this zone is stable under static loading conditions, it can be assumed safe for any expected earthquake loading. Since there are no formal static stability analyses, the theoretical seismic stability of this dam cannot be assessed.

SECTION 7
ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety. The visual inspection and the long-term performance of Still Creek Dam indicates that the dam embankment and foundation has and is performing satisfactorily and is in good condition for its age. The clear seeps near the toe of the dam do not, at present, indicate a serious hazard to the integrity of the dam; but, the lack of measurement records precludes any evaluation of change in seepage flow with time. Therefore, seepage should be monitored to evaluate if seepage rates increase or if turbid conditions develop. The spalling of concrete along the discharge channel is expected considering the age of the structure. This spalling should be repaired and the vegetation removed from the channel. The channel walls appear to be in relatively good condition but the vegetation should be removed to lessen the rate of deterioration.

A structural evaluation of the thrust block and bracing system should be made to determine if thrust rods need replacement.

The hydraulic and hydrologic analyses was performed using data developed by the Corps of Engineers for Bear Creek watershed, a nearby watershed. Using this data and the proper scaling effects, this analysis indicates that the dam would pass the PMF event. Thus, the spillway is considered "Adequate".

b. Adequacy of Information. The information available is such that the assessment of the safety of the dam embankment must be based primarily on the visual inspection, available hydraulic analysis and miscellaneous construction documentation.

c. Urgency. It is considered that the recommendations presented below be implemented as soon as practicable.

d. Necessity of Additional Studies. Although the data did not include summaries of the stability analyses of the embankment, the visual inspection of the embankment does not indicate that additional stability studies are needed. Additional studies should be performed as needed to implement the remedial measures.

7.2 Remedial Measures.

a. Facilities. It is recommended that the following measures be undertaken by the Owner.

1. The vegetation should be removed from the spillway channel to reduce the rate of deterioration. Similarly, the vegetation from the channel walls should be removed.
2. The spalled concrete, including the spillway crest, should be repaired.
3. The end of the spillway channel at the water fall should be evaluated and rehabilitation requirements determined by this study.
4. Thrust brace requirements at the valve cradles in the Valve House should be studied. If the evaluation deems it necessary, the braces should be replaced.
5. The structural integrity of the chimney is questionable considering that the steel used to repair it several years ago has deteriorated and buckled. The chimney should be repaired.
6. At seepage locations 1, 2, 3 and 7, shown in Appendix B, Sheet 5b, a program of periodic inspection of the downstream seepage should be implemented. Photographs and a written evaluation of the seeps (including an estimate of the seepage rate) should be periodically made and compared with the previous such observations.

b. Operation and Maintenance Procedures. Because of the location of the dam upstream from a populated area, a formal procedure of observation and warning during periods of

high precipitation should be developed and implemented. The Owner should also develop an operational procedure to follow in the event of an emergency. A maintenance inspection checklist should also be developed to help insure that all critical items are inspected on a periodic basis, including the water supply outlet and reservoir drawdown pipes.

APPENDIX

A

CHECK LIST		NAME OF DAM	Still Creek Dam
ENGINEERING DATA		ID #	PA 00700
DESIGN, CONSTRUCTION, OPERATION			
PHASE I			

ITEM

REMARKS

AS-BUILT DRAWINGS Construction drawings were the only drawings available. However, there were a few notes on these drawings apparently written by the Resident Engineer who noted a few modifications. Records do not indicate that As-Builts were issued, however, many design drawings were reissued to reflect design changes.

REGIONAL VICINITY MAP This data was located and replotted as shown on Plate 1 of the report.

CONSTRUCTION HISTORY Documentation consisted of miscellaneous letters and notes on the design drawings and several letters in the files. However, many letters contain contradictory data and other confusing information.

TYPICAL SECTIONS OF DAM These items were included in the design drawings and were available prior to the inspection

OUTLETS - PLAIN } This data was available on the design drawings.
DETAILS }

CONSTRAINTS - Documentation was not available in the Pennsylvania DER files.

DISCHARGE RATINGS - Data was not available in the Pennsylvania DER files.

RAINFALL/RESERVOIR RECORDS - Reservoir records were available for review together with rain data obtained on-site with a standard gage provided by the National Weather Service.

ITEM	REMARKS
DESIGN REPORTS	None available in the Pennsylvania State files.
GEOLOGY REPORTS	Pennsylvania State files contained a January 20, 1925 letter discussing the geology by Mr. George H. Ashley, State Geologist, a memorandum dated February 25, 1925, from Mr. J. D. Sisler, Associate Geologist, Geologic Survey and a report dated October 25, 1928 by Mr. Beal describing rock exposed at the site.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	There were no reports in the Pennsylvania State files.
MATERIALS INVESTIGATIONS BORING'S RECORDS LABORATORY FIELD	None available in the Pennsylvania State files.
POST-CONSTRUCTION SURVEYS OF DAM	None available in the Pennsylvania State files.
BORROW SOURCES	Design drawings indicated proposed borrow sources but no letters or documents could be found confirming their use.

Sheet 3 of 4

ITEM	REMARKS
MONITORING SYSTEMS	Flow monitoring is recorded on a Simplex Model MOL (#30-96-2806) device. but will be replaced in the near future with a Fisher-Porter, Model 50MF 2212ABCBB data chart system.
MODIFICATIONS	None in the files but it was observed that 1 to 3 feet of gravel fill was placed on top of the dam to construct a roadway. As noted on Plate 6, the venturi on the design drawing was not found as noted on the drawing. It is probably buried further downstream (approximately 10 feet).
HIGH POOL RECORDS	Maximum recorded flow over the weir was 7-1/2 inches occurring June, 1972 and January, 1978.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None other than inspection reports.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None
MAINTENANCE OPERATION RECORDS	The dam personnel only maintain flow records. It is reported that the Borough demand is approximately 2 mgd and that the combined Borough and Coal Company demand is approximately 5-1/2 to 6 mgd. It is understood that no other records are maintained at the site.

ITEM	REMARKS
SPILLWAY PLAN	
SECTIONS } DETAILS }	Blueprints of the spillway were available in the Pennsylvania State files
OPERATING EQUIPMENT PLANS & DETAILS	Blueprints of these facilities were in the Pennsylvania State files

APPENDIX

B

CHECK LIST
VISUAL INSPECTION
PHASE I

Name Dam	<u>Still Creek Dam</u>	County	<u>Schuylkill</u>	State	<u>Pennsylvania</u>	National
Type of Dam	<u>Earth and Rock</u>	Hazard Category	<u>I (High)</u>		ID #	<u>PA 00700</u>
Date(s) Inspection	<u>10 May 1978</u>	Weather	<u>Cloudy, Breezy</u>	Temperature	<u>58°F</u>	

Pool Elevation at Time of Inspection 1182.5 M.S.L. Tailwater at Time of Inspection 1097 M.S.L.

Inspection Personnel:

Mary Beck (Hydrologist)	<u>John H. Frederick (Geotechnical)</u>
John Boschuk (Geotech/Civil)	<u>Vincent McKeever (Hydrologist)</u>
Raymond Lambert (Geologist)	<u>John Boschuk, Jr.</u>
	Recorder

Remarks:

Other personnel on site included: Donald Matalearge - President, Water Board (operator)
 Wayne Davis - Caretaker of Dam
 Nicholas George - Department of Environmental Resources
 George Miller - Borough Councilman, Water Committee

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE	N/A	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	N/A	
DRAINS	N/A	
WATER PASSAGES	N/A	
FOUNDATION	N/A	

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	N/A	
STRUCTURAL CRACKING	N/A	
VERTICAL AND HORIZONTAL ALIGNMENT	N/A	
MOLOLITH JOINTS	N/A	
CONSTRUCTION JOINTS	N/A	

EMBANKMENT

<u>VISUAL EXAMINATION OF</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
SURFACE CRACKS	<i>None observed</i>	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	<i>None observed on either side of the centerline</i>	
SLoughing or Erosion of embankment and abutment slopes	<i>None observed on either side of the centerline</i>	
Vertical and horizontal alignment of the crest	<i>Alignment appeared very good. There were no signs of movement.</i>	
RIPRAP FAILURES	<i>None observed</i>	

EMBANKMENT

<u>VISUAL EXAMINATION OF</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
EMBANKMENT CREST	<p>It appears that the surface was filled with approximately 2 feet of stone for a road surface. Hand written notes on drawings indicate that the D/S slope was steepened to increase the crest width from 20 feet to 30 feet. A measurement across the crest below the stone surface confirms the 30 foot redesigned width.</p>	
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	<p>Spillway and embankment are separated by a natural knoll and are not connected. There was no noticeable seepage at the dam abutment contacts with the natural ground or the spillway abutments with the natural ground.</p>	
ANY NOTICEABLE SEEPAGE	<p>Yes. Seepage was observed at the downstream toe and beyond the toe in several locations as shown on the attached page 5a. Since the rock is fractured, bedded and susceptible to possible seepage as described in Appendix F, the seepage is probably predominantly through the foundation materials. Some seepage was also observed near the right abutment as shown on Page 5b. A detailed description is noted on Page 5a.</p>	
STAFF GAGE AND RECORDER	<p>The pumphouse has a flow meter (Simplex Model MOL #30-96-2806) which will be replaced with a Fisher Porter flow meter (Model 50MF2212ABCBB) within the next couple of months. Reservoir levels are measured each day with a Wayne Davis staff gage.</p>	
DRAINS	<p>There were no visible drains to observe and inspect.</p>	

SEEPAGE OBSERVATIONS

Sheet 5a of 11

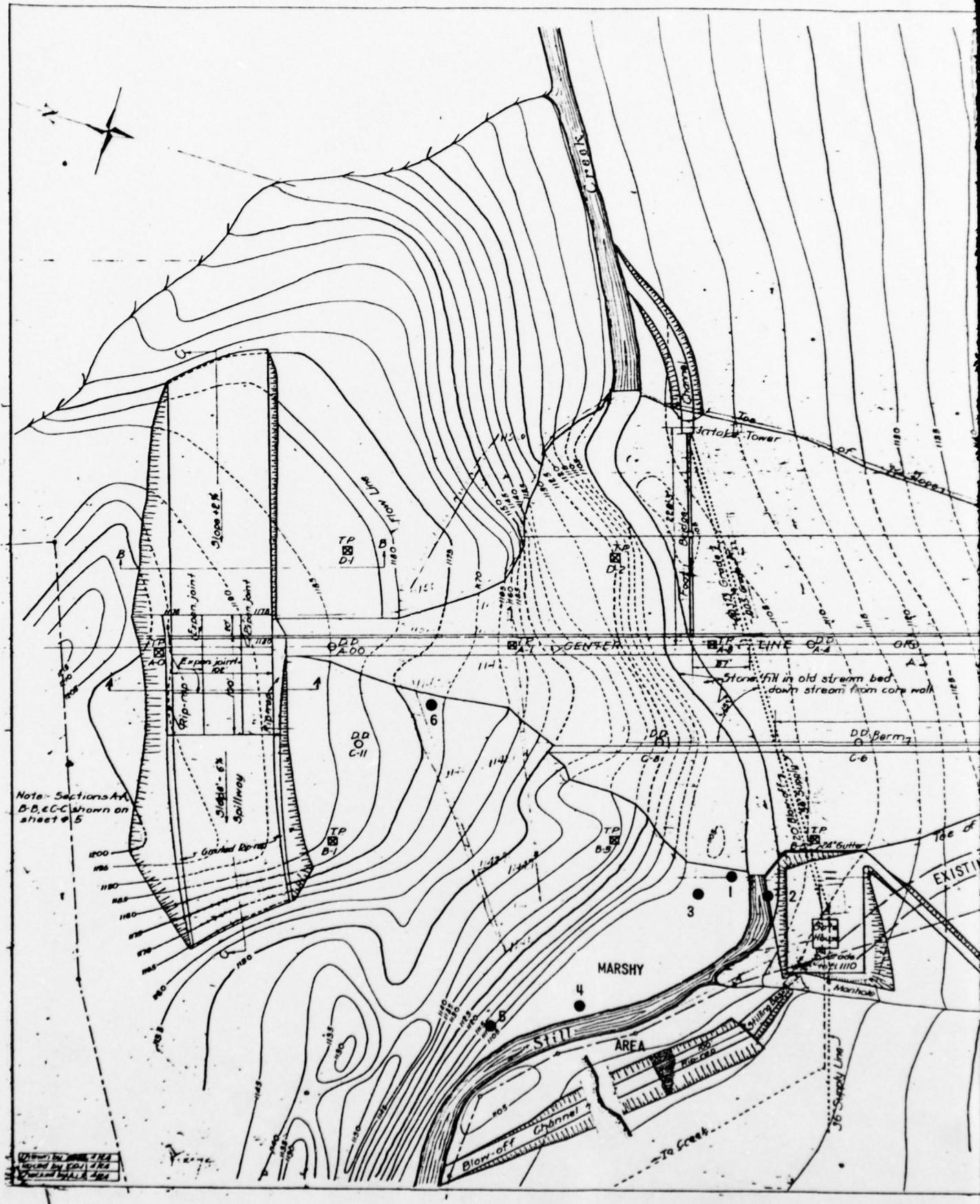
The observed water seeps are predominantly located within 100 to 200 feet of the dam crest (Sheet 5b). A lightly wooded area of overall marshy consistency (original Still Creek channel) is located just downstream from the toe of the dam and below the treatment building. This area (Location 1) is approximately 10 by 35 feet with water depths of up to 1 to 2 inches. No water flowage was observed in the upstream portion of this area. The water is a rust-brown color and was slightly odoriferous (hydrogen sulfide odor). Approximately 30 feet downstream from this marshy area (Location 2) water depths increase to 3 to 4 inches with visible minor flowage. On the northeast side of the pooled water is an irregular ground opening approximately 1/4 to 1/2 inch in diameter emitting a clear, turbulent flow of water at several gpm (unable to take accurate measurements). In this area the hydrogen sulfide odor was readily noticeable. The flowage of water then continues to the west where it joins water being discharged from behind the south wall of a weir behind the treatment building.

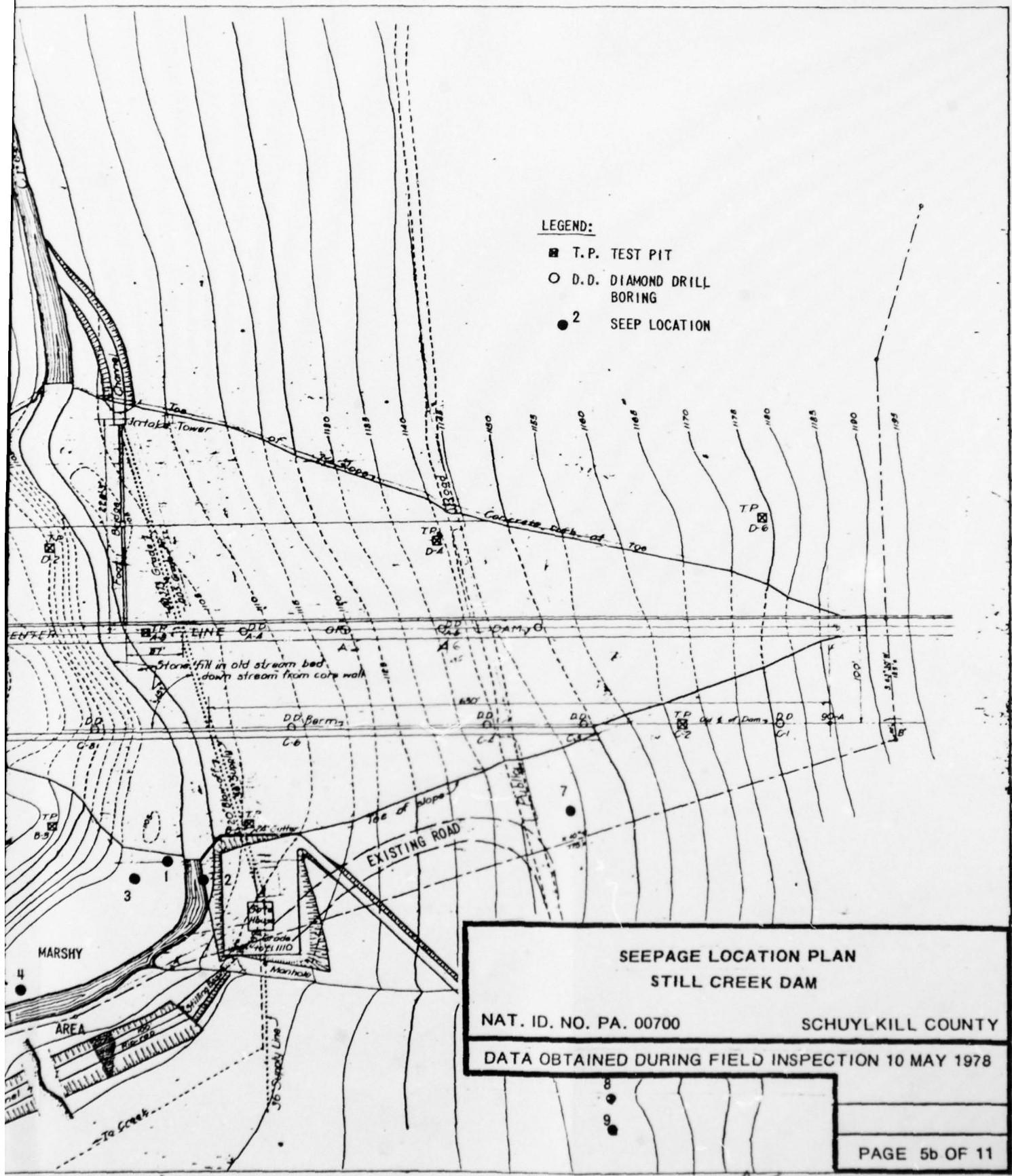
At the base of an uprooted tree near the toe of the dam (Location 3) at the northwest abutment is a generally marshy area with standing water. This water flows into an area of marshy and pooled depressions in the pine woods approximately 100 feet southwest of the northwest abutment. As this flowage of water continues to the southwest, it joins an area of pooled water (Location 4) with one pool being nearly 50 feet in diameter and 6 to 12 inches deep. Up slope from this area is a bedrock outcrop (Location 5) with a southerly dip of approximately 60 degrees where an audible flowage of water was detected.

Progressing up the terraced slope near the northwest abutment just at the riprap margin (Location 6) an area approximately 5 by 30 feet (old spillway location) with 1 to 2 inches of standing, clear water was observed. This is the only pooled water observed above the toe of the dam in the abutment areas.

Several seepage areas were observed in the southeast abutment area. One is (Location 7) located in the woods adjacent to the dirt access road. Two additional water seeps (possible springs) were observed on both sides of a pipeline (Locations 8 and 9) where it crosses the paved road which leads to Route 309.

Factors which may be conducive for water seepage in the Still Creek Reservoir area include the north-northeast strike and south-southeast dip of the bedrock, the northeast strike and low angle dip of one set of bedrock joints. Also, the general thin-bedded nature of the rock would contribute to water seepages.





**SEEPAGE LOCATION PLAN
STILL CREEK DAM**

NAT. ID. NO. PA. 00700

SCHUYLKILL COUNTY

DATA OBTAINED DURING FIELD INSPECTION 10 MAY 1978

PAGE 5b OF 11

OUTLET WORKS

Sheet 6 of 11

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	The conduit was buried and could not be inspected except for the end portion in the downstream pumphouse. This small section of pipe was in good condition.	
INTAKE STRUCTURE	Intake Structure (tower) was in good to excellent condition for its age. There were no significant cracks or deterioration. All intake valves were exercised and appeared to be in good condition. The operator said that the sluice gates and other underwater components were refurbished in the Fall of 1976. The blow-off valve used for emergency drawdown is reportedly exercised once a year.	
OUTLET STRUCTURE	All valves in the outlet structure were inspected, exercised and found to be in good condition. All components within the structures were inspected and observed to be in good condition except the thrust rods for the intake pipe. The anchor bolts and hold-down flanges for these rods were deteriorated and are not capable of anchoring the intake pipes. These anchor rods should be replaced. The pumphouse building was inspected and appeared to be in good condition except the chimney and bearing plate on the chimney for the roof frame. It appears that the chimney cracked several years ago and was reinforced with channel steel and straps. The steel has deteriorated and buckled allowing the chimney to crack further. The chimney should be repaired.	
OUTLET CHANNEL	Blow-Off Valve: This channel was inspected and observed to be in good condition from the pumphouse to the natural channel below the retaining wing walls.	
EMERGENCY GATE	(Blow-Off Valve): The valve was inspected, exercised and observed to be in good condition.	

UNGATED SPILLWAY

Sheet 7 of 11

<u>VISUAL EXAMINATION OF</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
<u>CONCRETE WEIR</u>	The weir has spalled and one section was repaired a couple of years ago. However, most of the weir crest is spalled and cracked and will need repair in the near future. Both abutments of the spillway are in good condition. The weir is 108 feet long and approximately 215 feet above the outlet channel floor.	
<u>APPROACH CHANNEL</u>	It appears to be in good condition and is 165 feet wide at the entrance.	
<u>DISCHARGE CHANNEL</u>	Most of the channel is in good to fair condition but will need repair in the near future. The end of the channel discharges into a rock slope which appears to be stable under normal flow conditions. However, during low frequency return storms, some degradation is expected. It is sufficiently far away from the dam so the risk of affecting the spillway crest is low. This discharge (water falls) channel should be inspected after each significant storm. The channel was constructed on a one percent grade for a distance of 276 feet. The floor consists of grouted rubble rock. Thereafter, the channel narrows and the grade increases from 2 to 12 percent before discharging into the downstream channel. The section consists of concrete slabs which are spalling.	
<u>BRIDGE AND PIERS</u>	A small bridge exists approximately 2500 feet downstream of the spillway and is estimated to pass about 7,500 cfs before overtopping the road.	

GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	N/A	
APPROACH CHANNEL	N/A	
DISCHARGE CHANNEL	N/A	
GATES AND OPERATION EQUIPMENT	N/A	<p>BRIDGE AND PIERS (to the Control Tower): The bridge is in good condition and serviceable. It is noted that the bridge pier located midway between the tower and embankment is tilted towards the embankment. It was reported by the Owner that ice forces caused this movement and divers inspected the pier and said it was structurally sound. Since then, an aeration system was installed to prevent ice formation around the pier.</p>

INSTRUMENTATION

<u>VISUAL EXAMINATION</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
MONUMENTATION/SURVEYS	<i>None</i>	
OBSERVATION WELLS	<i>None</i>	
WEIRS	<i>None</i>	
PIEZOMETERS	<i>None</i>	
OTHER	<i>None</i>	

RESERVOIR

Sheet 10 of 11

<u>VISUAL EXAMINATION OF</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
SLOPES	Reservoir slopes are flat to moderate, generally well vegetated with trees and grass. However, as the Borough of Tamaqua does not own all land adjacent to the reservoir, some agriculture operations are being performed which is a potential source of sedimentation, volume of sediment will be negligible and will not affect flood storage.	
SEDIMENTATION	Sedimentation that has taken place is minimal and does not affect flood storage. Reportedly, the upper end of the reservoir is shallow and when the water level in the reservoir was low during the summer of 1977, there was very little sedimentation in the water supply storage area. Few trees or logs can enter the water. However, the normal procedure is to remove any that happen to enter the reservoir.	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
	The downstream channel below the overfall is narrow with a wide flood plain on the left side of the channel. The banks of the channel and the floor plain are heavily covered with brush and trees. Some trees have fallen across the channel. The highway bridge (noted on Sheet 7) opening is approximately 40 feet wide and 24 feet high.	
SLOPES	The valley gradient of the channel immediately downstream of the overfall is fairly steep for approximately 100 feet where the gradient flattens out enough for the stream bottom to be mainly sand. The side slope of the channel is steep on the right side and the floor plain slopes gently up on the left side.	
APPROXIMATE NO. OF HOMES AND POPULATION	Ten to fifteen homes and major appurtenant structures were counted downstream of the dam which would be subject to damage in the event of total failure.	

APPENDIX

C

STILL CREEK DAM
CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: Sparingly populated, predominantly wooded

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 1182.3

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): 1192 top of dam

ELEVATION MAXIMUM DESIGN POOL: 1187 ft. (design)

ELEVATION TOP DAM: 1192

SPILLWAY:

- a. Elevation 1182.3 ft.
- b. Type Concrete chute with 30-inch high ogee weir
- c. Width N/A
- d. Length 108 ± (field checked)
- e. Location Spillover Right abutment
- f. Number and Type of Gates N/A

OUTLET WORKS: (Water Supply)

- a. Type Intake Tower with 36-inch water pipe connected to Valve House (Plate 4)
- b. Location Upstream of the embankment (See Plate 4)
- c. Entrance inverts 1145 and 1125
- d. Exit inverts 1097 at Valve House
- e. Emergency draindown facilities 20-inch blow-off pipe at base of tower (El. 1100); controlled at Valve House (El. 1096.6) (1)

HYDROMETEOROLOGICAL GAGES:

- a. Type Standard Rain Gage
- b. Location At the dam
- c. Records Maintained since 1934, records sent to Weather Service

MAXIMUM NON-DAMAGING DISCHARGE: 7500 cfs (estimated)

(1) This size is doubtful; visual inspection indicates 36" pipe through concrete wall into Valve House

DAM SAFETY ANALYSIS
HYDROLOGIC/HYDRAULIC DATA

Date: 5/8/70
By: MFB
Sheet: 2 of 8

DAM Still Creek Dam Nat. ID No. PA 700 DER No. 54-111

ITEM/UNITS	Permit/Design Files (A)	Calc. from Files/Other (B)	Calc. from Observations (C)
1. Min. Crest Elev., ft.		<u>1192.0</u>	
2. Freeboard, ft.	<u>3 ft</u>	<u>0</u>	
3. Spillway ⁽¹⁾ Crest Elev., ft.		<u>1102.3 ft.</u>	
3a. Secondary ⁽²⁾ Crest Elev., ft.	<u>—</u>		
4. Max. Pool Elev., ft.			
5. Max. Outflow ⁽³⁾ , cfs	<u>6200 cfs @ H=7ft</u>	<u>9700 cfs (H=9.7')</u>	
6. Drainage Area, mi ²	<u>8.5 mile²</u>	<u>8.7 mile²</u>	<u>6.9 mile²</u>
7. Max. Inflow ⁽⁴⁾ , cfs		<u>30500 cfs</u>	
8. Reservoir Surf. Area	<u>.359 Ac</u>		<u>.332 Ac</u>
9. Flood Storage ⁽⁵⁾		<u>3200 Ac-Ft</u>	
10. Inflow Volume, ft ³			

Reference all figures by number or calculation on attached sheets:

Example: 3A - Drawing No. xxx by J. Doe, Engr., in State File No. yyyy.

NOTES:

- (1) Main emergency spillway.
- (2) Secondary ungated spillway.
- (3) At maximum pool, with freeboard, ungated spillways only.
- (4) For B, C, use PMF.
- (5) Between lowest ungated spillway and maximum pool.

Date: 5/8/78
By: HFB
Sheet: 3 of 8

HYDROLOGIC/HYDRAULIC CALCULATIONS (cont.)

Item (from sheet 2)	Source
2A, 5 , 6A, 8A	Application Report, January 7, 1925
5B, 6B, 3B, 1B 7B, 9B	PMF Flood Routing by Soil Conservation Service, Dec. 9, 1963, located in State File 54-174
6C, 8C	USGS Maps Tamaqua (1976) Hazleton (1969)

BY MFB DATE 6/1/78 SUBJECT Hydrology & Hydraulics
CHKD BY JH DATE 6/19/78 Still Creek Dam SHEET 4 OF 8
JOB NO. _____

Information Supplied By OGE

Bear Creek

Drainage Area = 12 sq. miles

PMF Q_I (estimated) = 16,320 cfs

Assume Q_I Proportional to Drainage Areas

Peak Inflow to Still Creek = $(\frac{6.7}{12})^{0.8} 16,320$

$Q_I = 10,482$ cfs est. PMF

Volume of Inflow

PMP = 25 inches 6-hr - 10 mile² TP-40

assume 90% runoff

Runoff = 22.5 inches

DAM SAFETY ANALYSIS
HYDROLOGIC/HYDRAULIC CALCULATIONS

Date: 6/1/78
By: MFB
Sheet: 5 of 8

DAM Still Creek Nat. ID No. PA 00700 DER No. 54-111
Calculations for Design /, As-Built /, Existing / Conditions

1. Spillway Discharge at Max. Pool*, Q_{omac} 9700 cfs
Freeboard at Max. Pool 0 ft.
2. Tributary Drainage Area*, A 6.9 mi²
3. From Corps
a) Inflow hydrograph peak flow, Q_{Imax} 10,482 cfs at 100% PMF

IF Q_{omax} exceeds Q_{Imax} , check here and stop /

4. Calculate $p = Q_{\text{omax}}/Q_{\text{Imax}} = \frac{9700}{10482} = 0.9254$.

5. Calculate Volume of inflow hydrograph, V_I

$$V_I = \times \frac{\frac{22.5 \text{ in}}{12 \text{ in}/\text{ft}} \times 6.9 \times 640}{= 8200 \text{ Ac-ft}}$$

6. Calculate volume of storage between normal and maximum pool, V_s

Crest Elevation	=	ft.
Freeboard**	=	ft.
El. Max. Pool	=	ft.
El. Normal Pool**	=	ft.
Storage Height	=	ft.

Area of reservoir from USGS quad sheet*, _____ ft²

$$V_s = \text{Storage} = 3200 \text{ Ac-ft} \quad (\text{FROM SCS; } 12/9/1963)$$

IF V_s exceeds V_I , check here and stop /.

* Attach calculations or source.

** Attach justification for values selected.

HYDROLOGIC/HYDRAULIC CALCULATIONS (cont.)

DAM Still CreekDesign , As-Built , Existing Date: 6/19/78
By: MFB
Page 6 of 87. Calculate storage required to pass flood, V_R

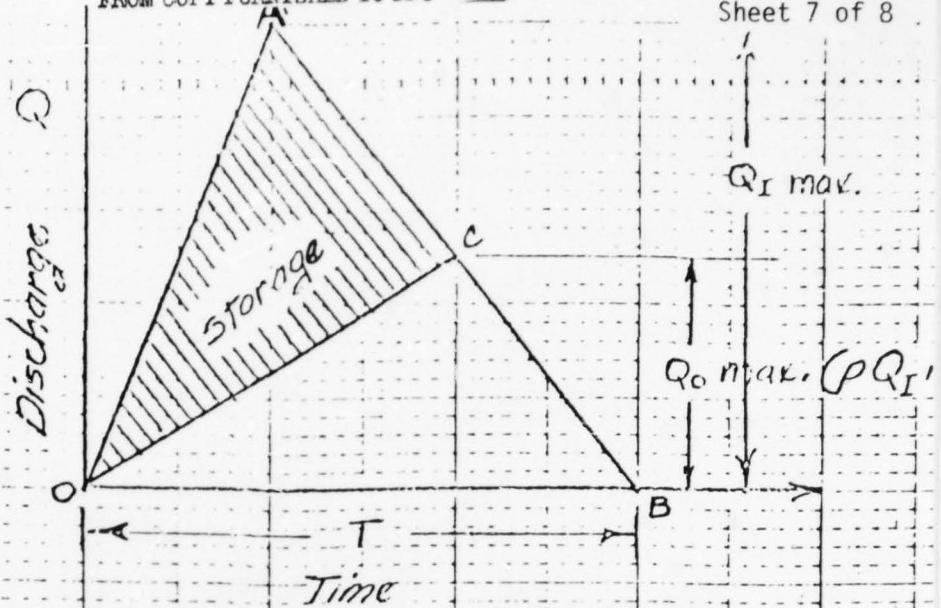
$$V_R = (1-p) V_I = (1 - .9059) \times 8280 = 617.72 \text{ Ac-Ft}$$

IF V_S exceeds V_R , check here and stop .8. Calculate freeboard storage, V_F

$$V_F = \text{Freeboard} \times \text{Area} = \underline{\quad} \times \underline{\quad} = \underline{\quad} \text{ ft}^3$$

Does V_R exceed $V_S + V_F$? If yes, repeat for 1/2 PMF, if this calculation is for 1/2 PMF, and answer is still yes, dam may be unsafe.SUMMARY

- Dam passes PMF with some ft. freeboard . . .
 PMF with no freeboard
 1/2 PMF with ft. freeboard .
 1/2 PMF with no freeboard
 None of the above



PURPOSE: Establish relationship between maximum spillway discharge and storage required to pass flood hydrograph without exceeding maximum pool level.

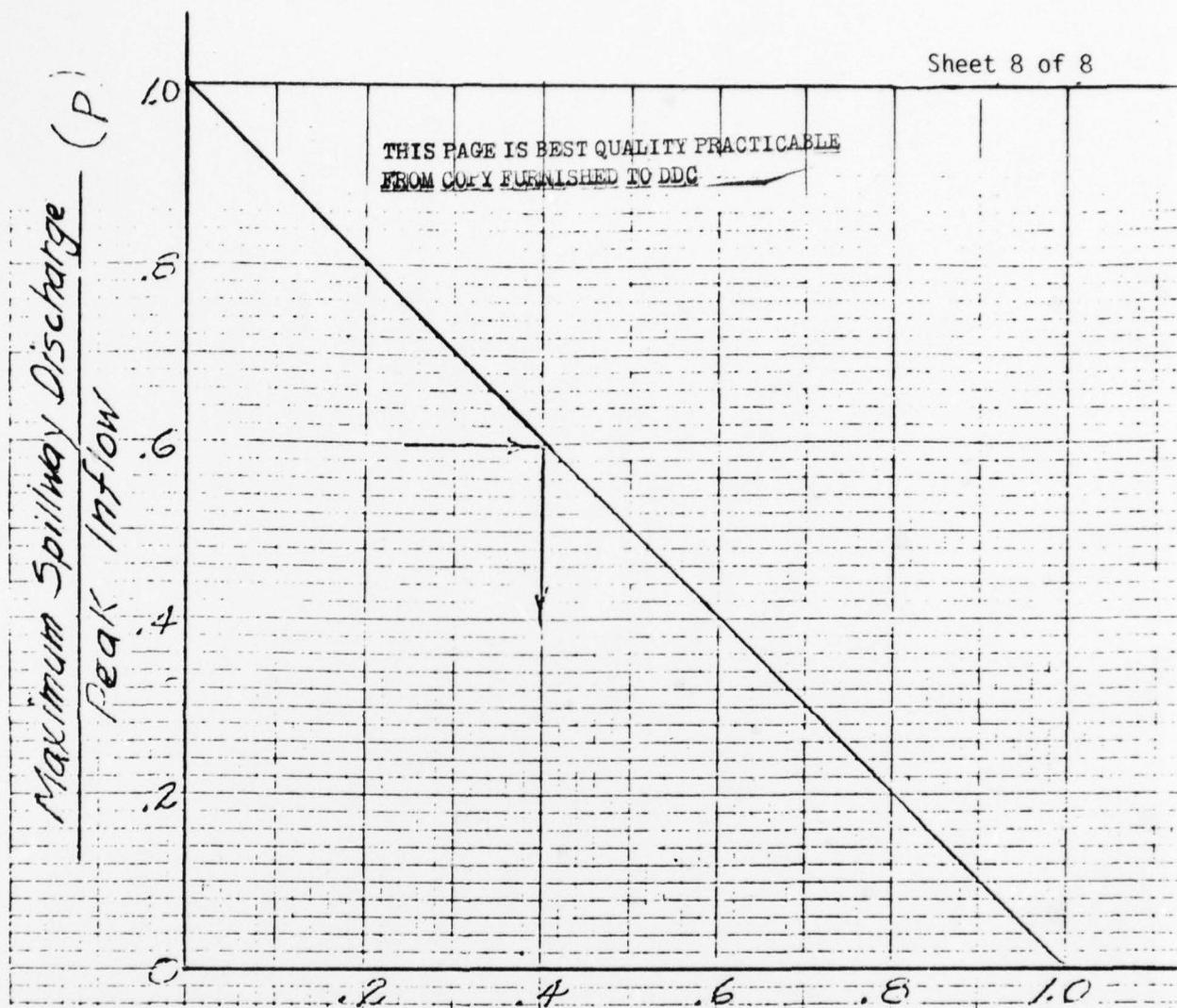
$$\frac{\Delta AOC}{\Delta AOB} = \frac{\Delta AOB - \Delta COB}{\Delta AOB} = 1 - \frac{\Delta COB}{\Delta AOB}$$

$$\frac{\Delta AOC}{\Delta AOB} = 1 - \frac{T \rho Q_I \max / 2}{T Q_I \max / 2} = 1 - \rho$$

$$\Delta AOC = (1 - \rho) \Delta AOB \text{ where } 0 \leq \rho \leq 1$$

$$\rho = \frac{\Delta AOC}{\Delta AOB}$$

REFERENCE	1.00	0
PRELIMINARY ENGINEER TECHNICAL LETTER NO. 1110-2- 25 January 1978	0.75	0.25 ΔAOB
	0.50	0.50 ΔAOB
	0.25	0.75 ΔAOB
	0	1.00 ΔAOB



(1-P)

Required Reservoir Storage

Volume of Inflow Hydrograph

Steps to obtain required reservoir to pass inflow hydrograph without overtopping dam.

1. Obtain maximum spillway discharge
2. Develop inflow hydrograph
3. Compute relationship of maximum spillway capacity to peak inflow
4. Read relationship of required reservoir storage to volume of inflow hydrograph from curve

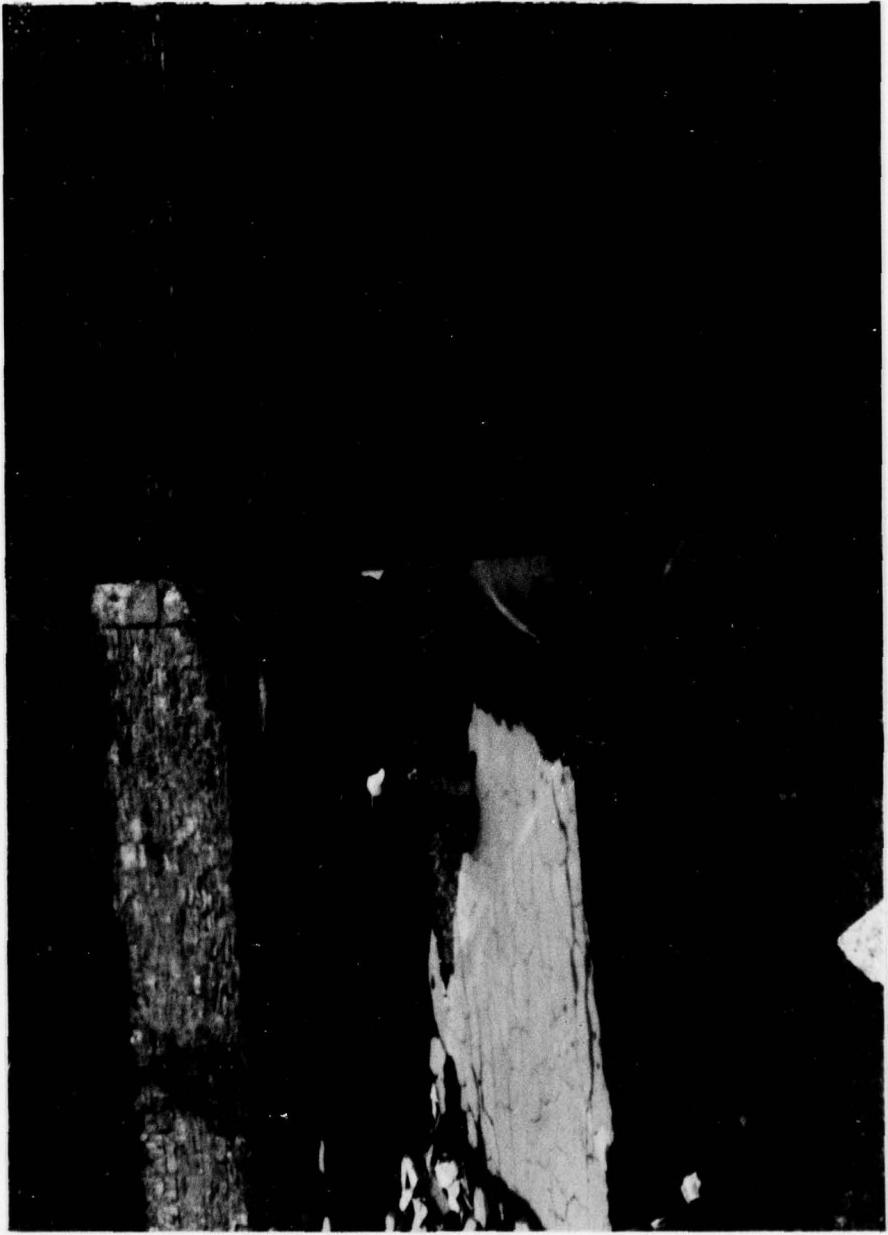
APPENDIX

D



VIEW OF INTAKE CONTROL TOWER LOOKING FROM THE LEFT ABUTMENT. BRIDGE SUPPORT WAS TILTED BECAUSE OF ICE FORCES. AERATORS AROUND THE INTAKE TOWER NOW PREVENT ICE FORMATION.

PHOTO NO. 1



VIEW OF EMERGENCY SPILLWAY LOOKING FROM LEFT ABUTMENT
TOWARDS RIGHT ABUTMENT.

PHOTO NO. 2



VIEW FROM CENTERLINE OF EMERGENCY SPILLWAY LOOKING UPSTREAM. SPILLWAY CREST CAN BE SEEN ACROSS CENTER OF PHOTO. EMBANKMENT IS ON THE RIGHT BEYOND CAMERA VIEW.

PHOTO NO. 3

PHOTO NO. 4

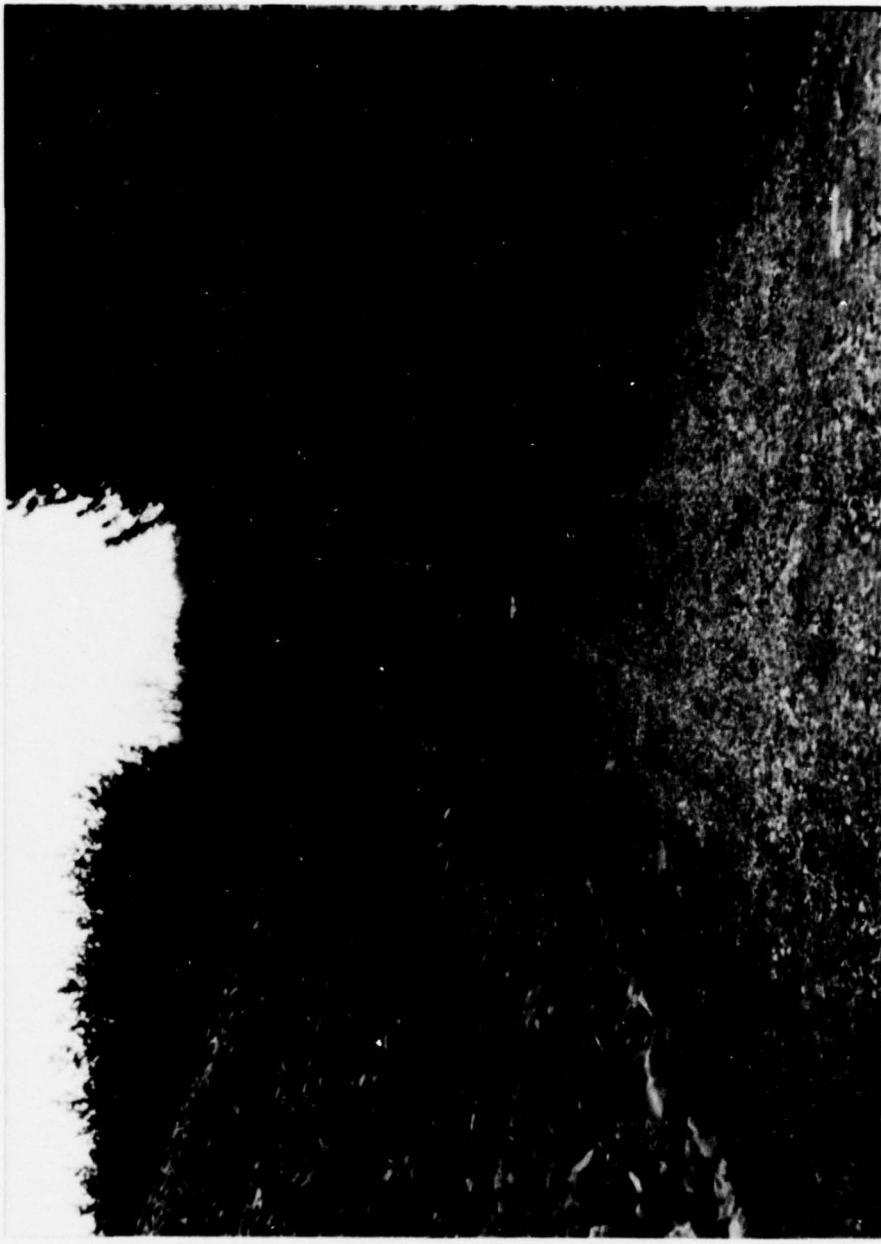


EDGE OF EMERGENCY SPILLWAY. NOTE SPALLED CONCRETE CHANNEL. DISCHARGE DROPS INTO NATURAL STREAM CHANNEL AS SHOWN ON PHOTO NO. 5.



VIEW OF NATURAL STREAM CHANNEL DOWNSTREAM OF EMERGENCY
DISCHARGE CHANNEL. PHOTO TAKEN FROM END OF CHANNEL
SHOWN ON PHOTO NO. 4.

PHOTO NO. 5



TOE OF DAM LOOKING TOWARDS THE LEFT ABUTMENT. GRAVEL FILLED ROADWAY IN FOREGROUND IS A PERPETUAL WET ZONE REQUIRING REGULAR MAINTENANCE.

PHOTO NO. 6

PHOTO NO. 7



TYPICAL SEEPAGE ZONE. THIS PARTICULAR ZONE IS LOCATED APPROXIMATELY 50 FEET DOWNSTREAM OF THE DAM TOE AND 150 FEET RIGHT OF CENTER. SEEPAGE EMERGES IN THE UPPER LEFT SIDE OF PHOTO NEAR FALLEN TREE.

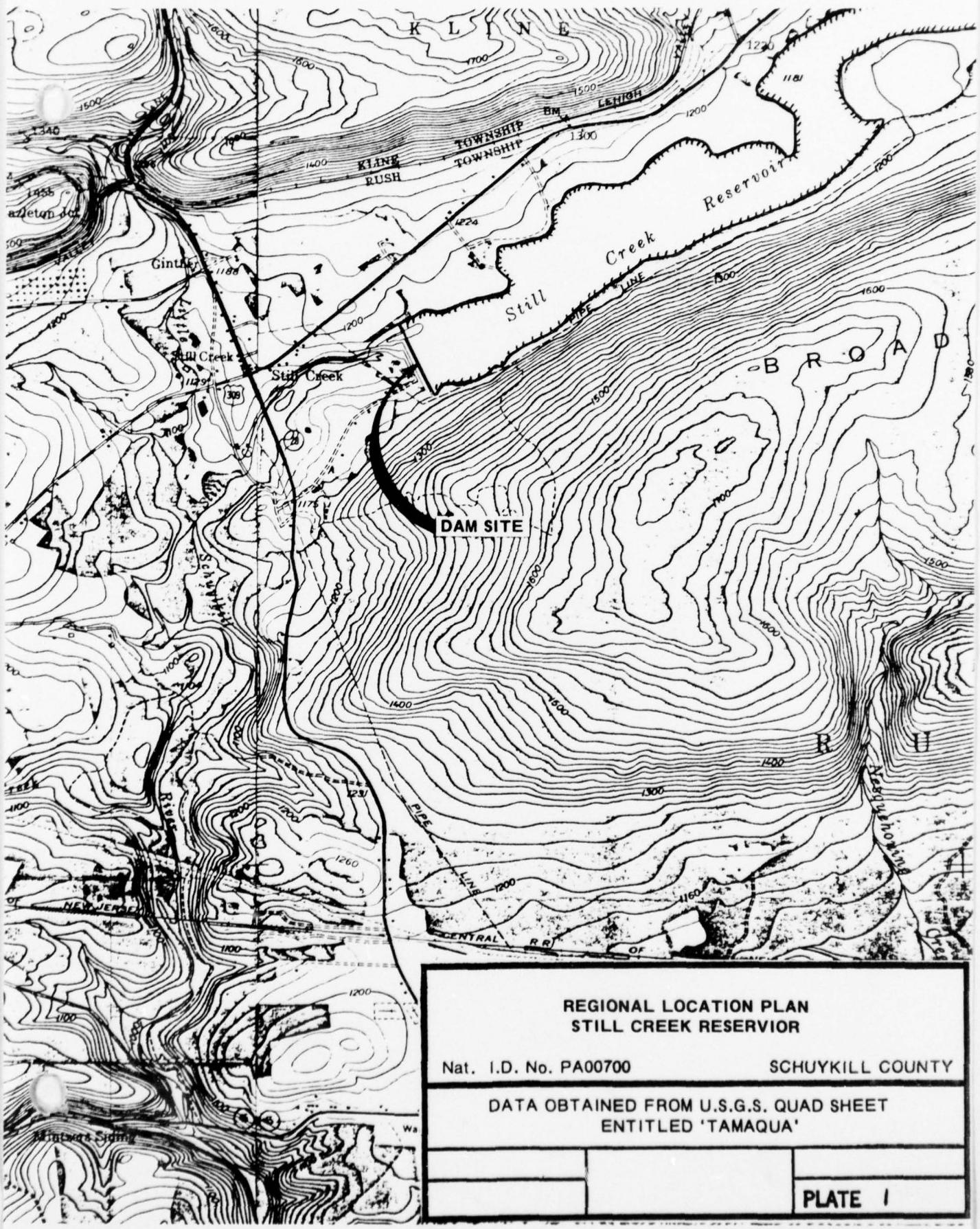


SOME SEEPAGE EMERGES THROUGH THE JOINTED
ROCK DOWNSTREAM OF THE DAM. THIS PHOTO
WAS TAKEN ON THE SOUTH DIPPING LIMB OF THE
DELANO ANTICLINE OUTCROP OF THE MAUCH CHUNK
SANDSTONE.

PHOTO NO. 8

APPENDIX

E

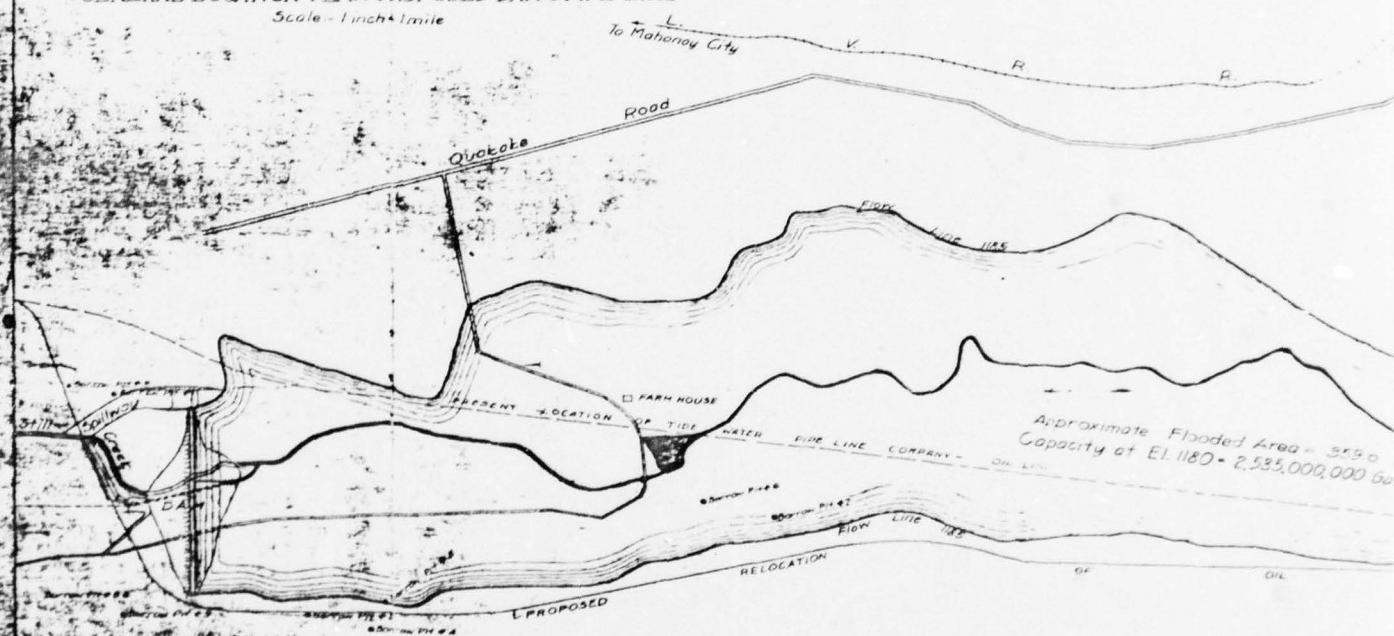




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GENERAL LOCATION PLAN PROPOSED DAM & PIPE LINE

Scale - 1 inch = 1 mile



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PLAN OF DAM AND RESERVIOR
STILL CREEK DAM

NAT. ID NO. PA. 00700

SCHUYLKILL COUNTY

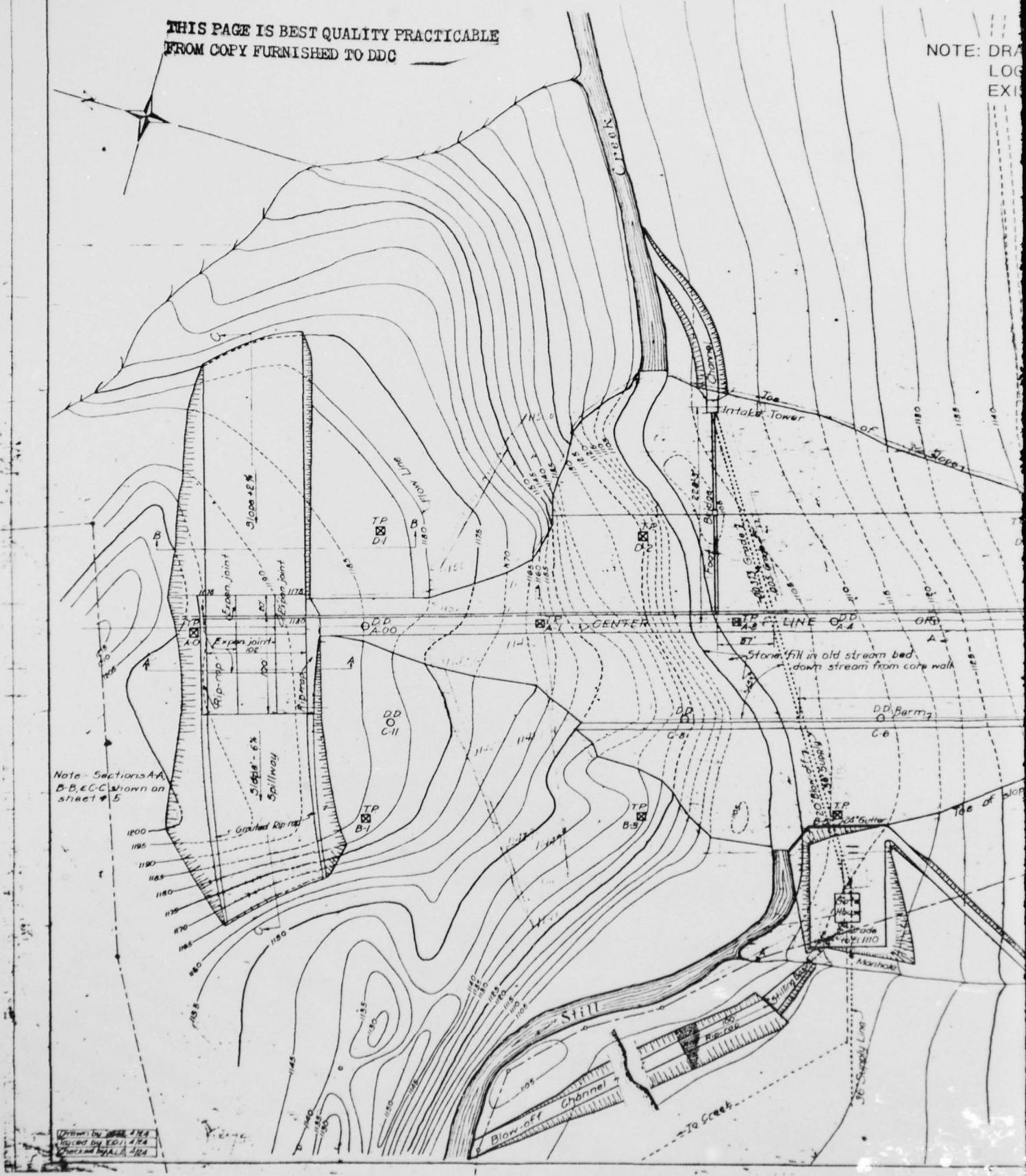
DATA OBTAINED FROM GANNETT, SEELYE & FLEMING
ENGINEERS DRAWING SHEET 1 OF 15, DATED APRIL 1924

PLATE 2

2

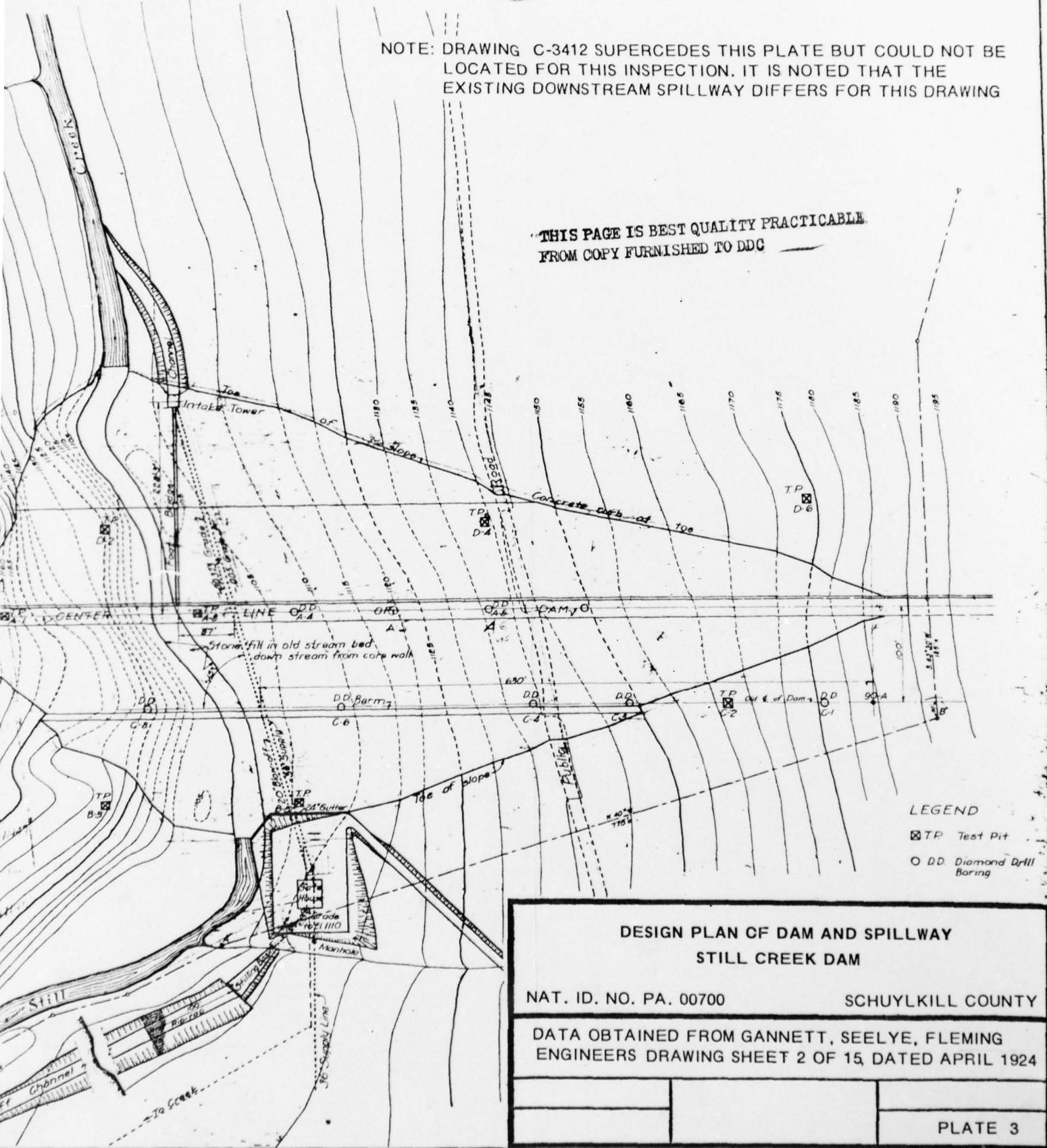
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NOTE: DR/
LOG
EXI



NOTE: DRAWING C-3412 SUPERCEDES THIS PLATE BUT COULD NOT BE LOCATED FOR THIS INSPECTION. IT IS NOTED THAT THE EXISTING DOWNSTREAM SPILLWAY DIFFERS FOR THIS DRAWING

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**DESIGN PLAN OF DAM AND SPILLWAY
STILL CREEK DAM**

NAT. ID. NO. PA. 00700

SCHUYLKILL COUNTY

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ENGINEERS DRAWING SHEET 2 OF 15 DATED APRIL 1924

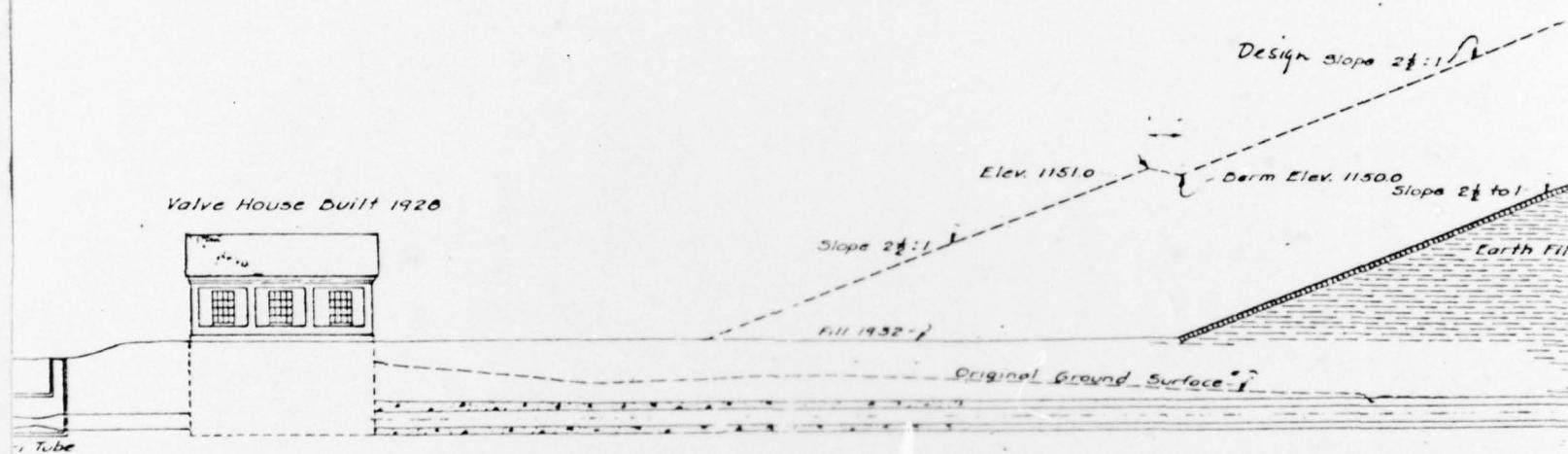
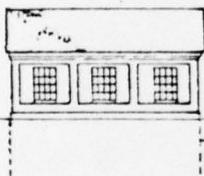
PLATE 3

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ACT

Valve House Built 1928

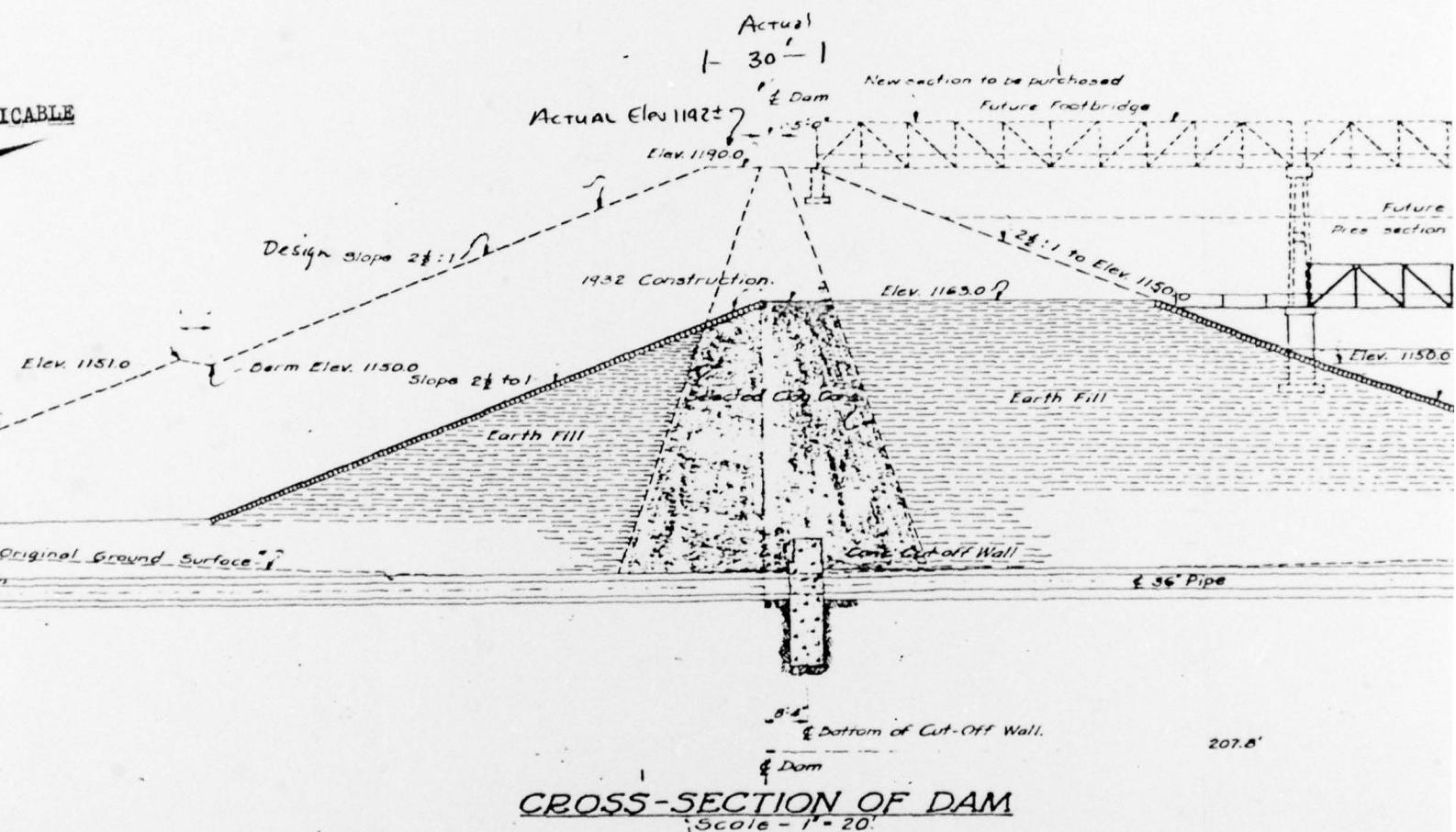


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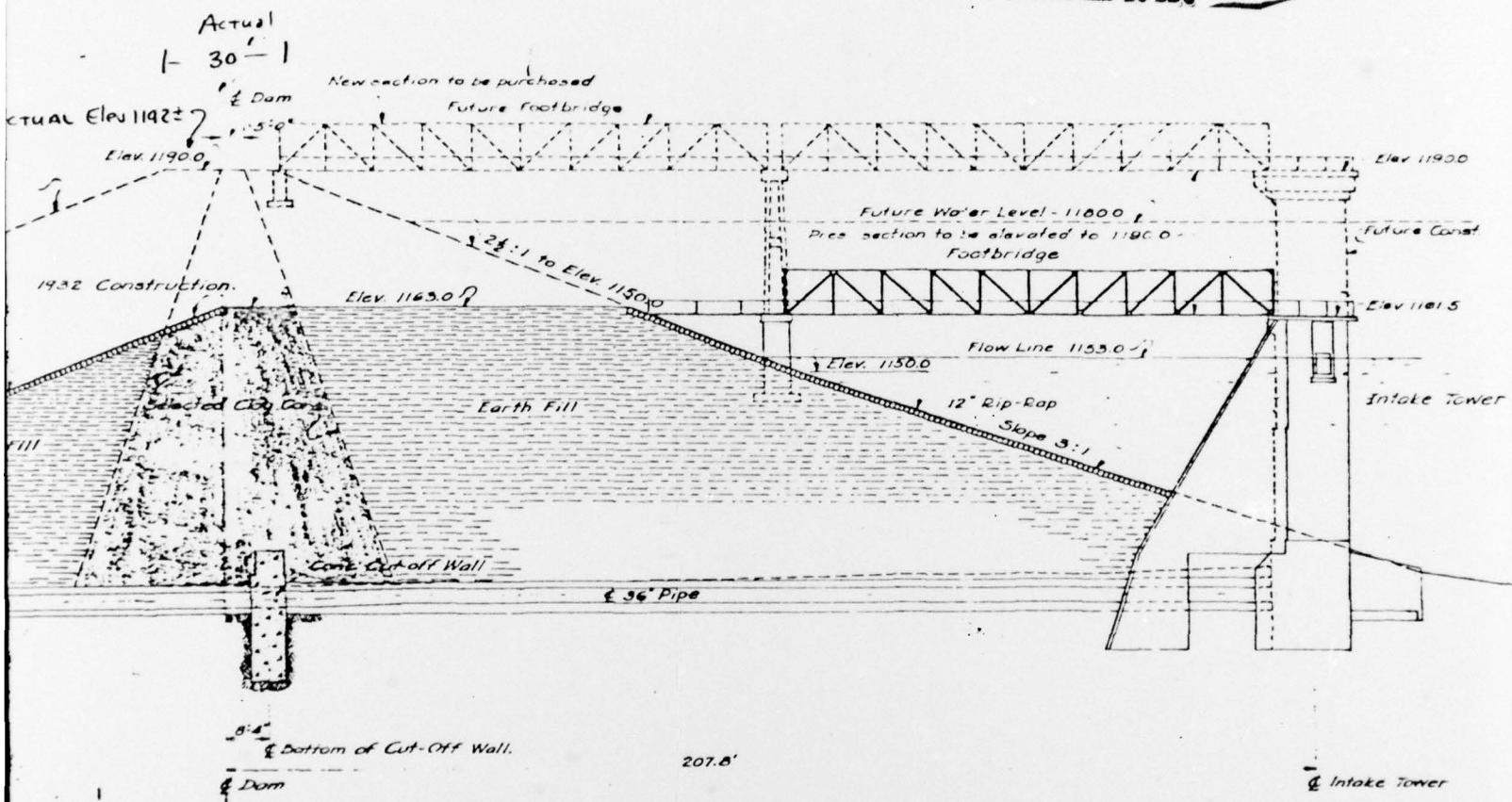


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BOSS-SECTION OF DAM

Score - 1 - 20

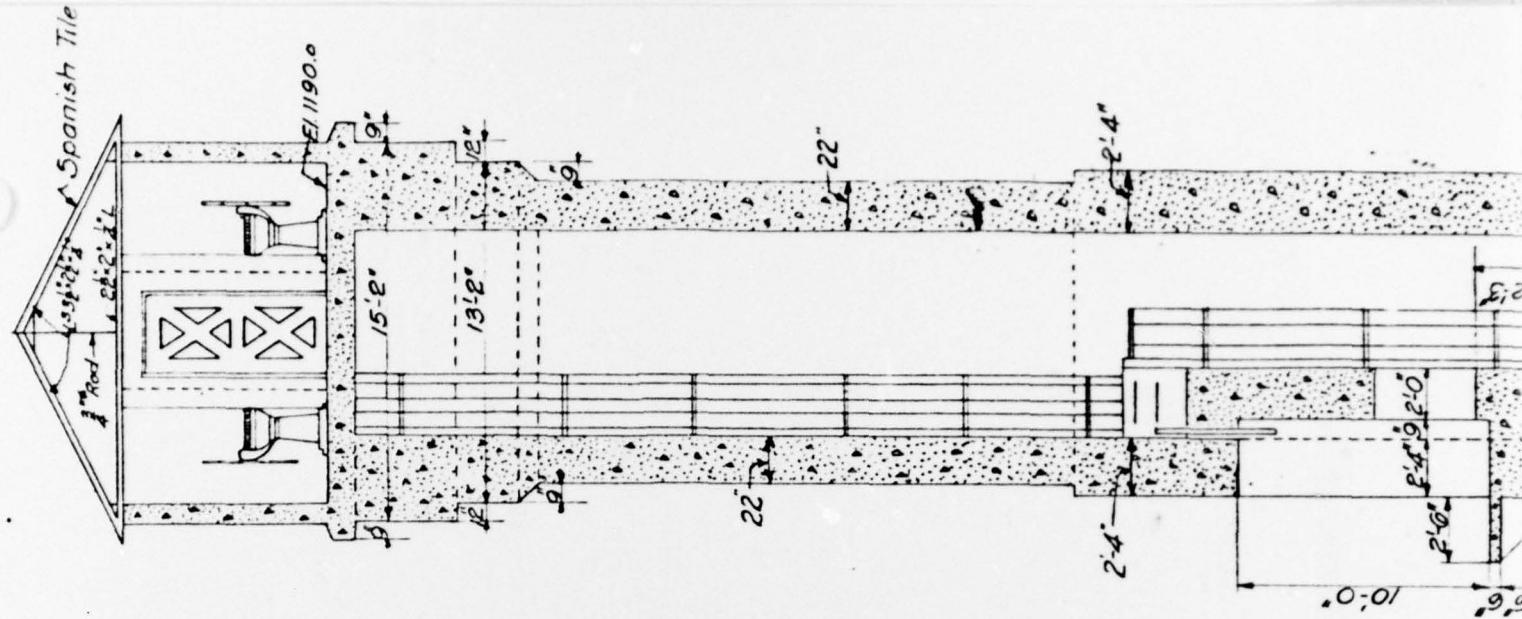
**TYPICAL EMBANKMENT SECTION
STILL CREEK DAM**

NAT. ID. NO. PA. 00700

SCHUYLKILL COUNTY

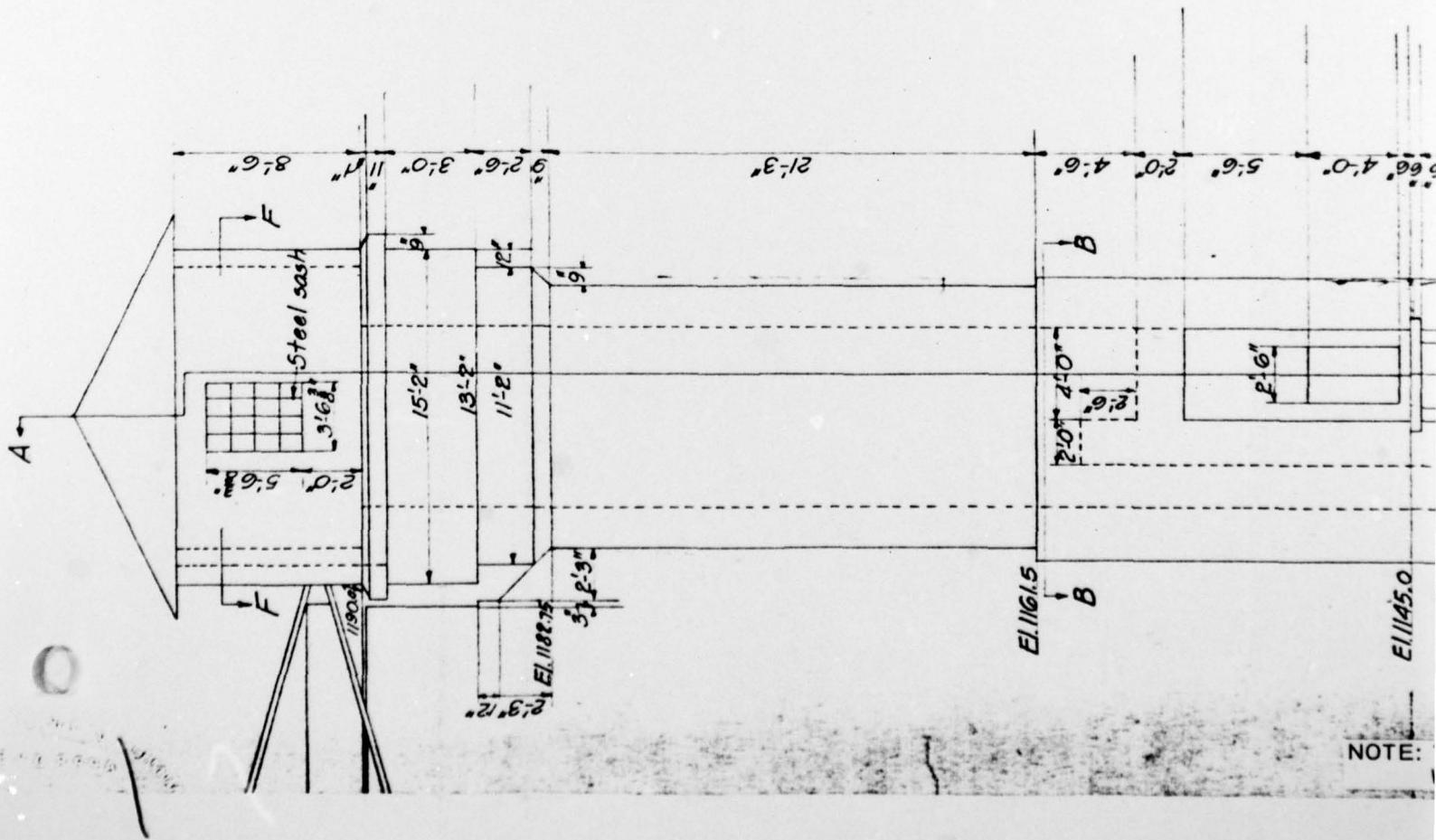
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ENGINEERS DRAWING SHEET 5 OF 15, DATED JAN.1933

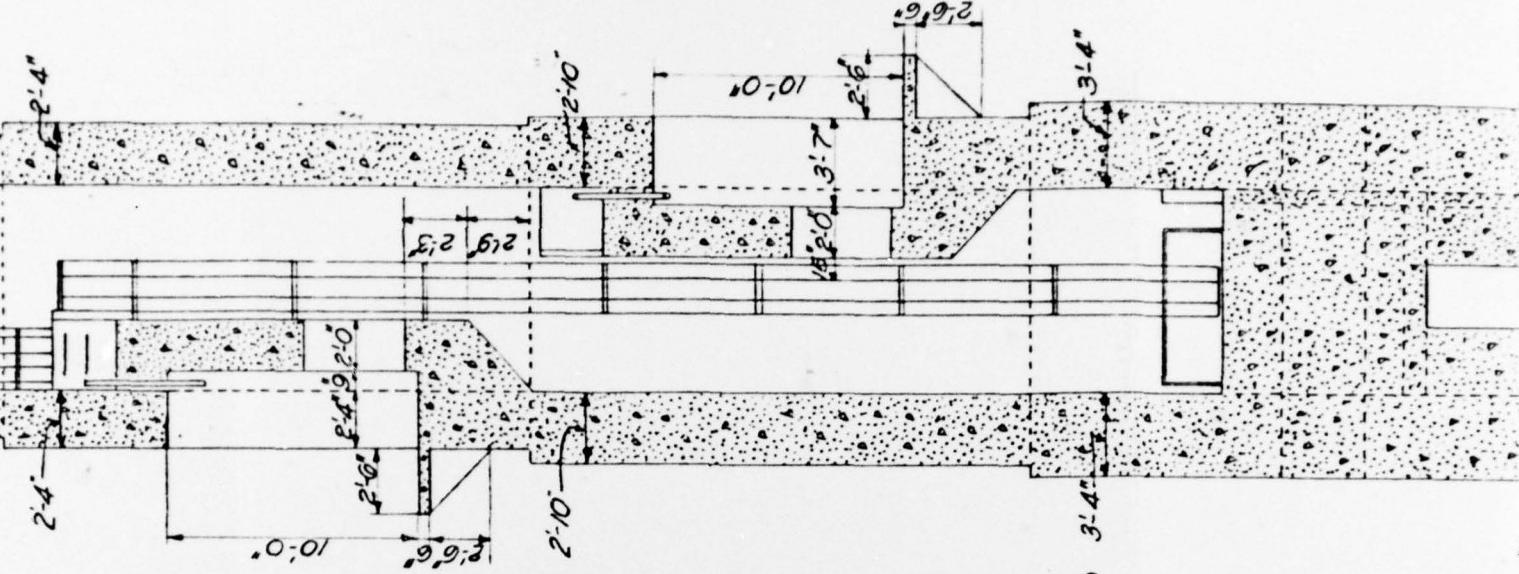
PLATE 4



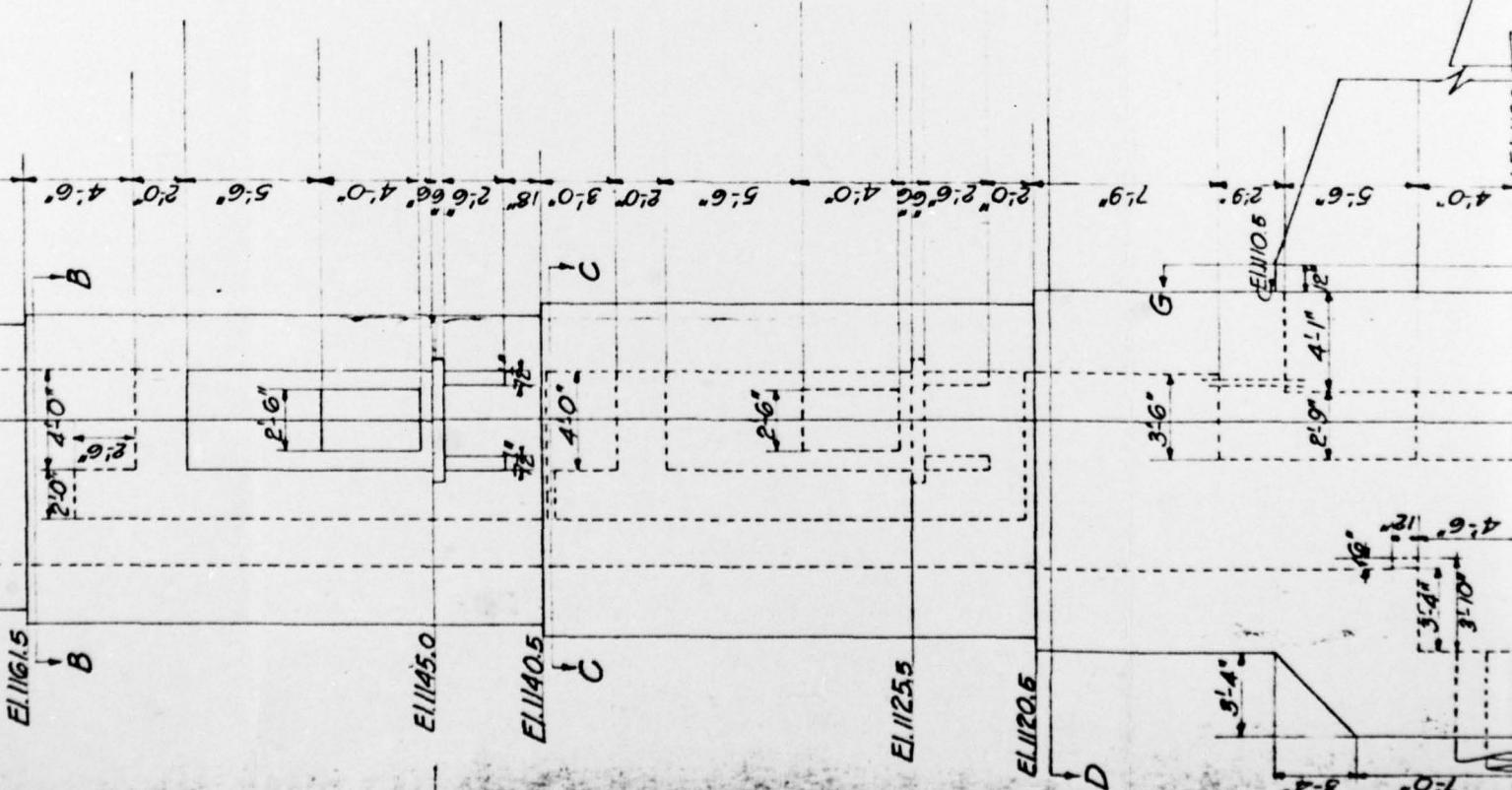
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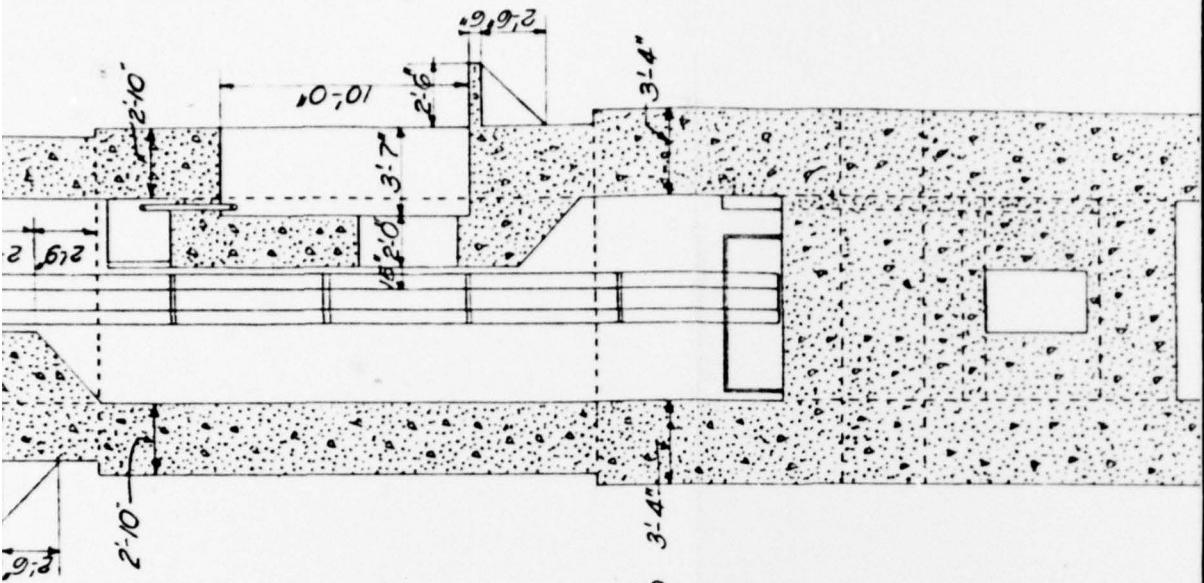




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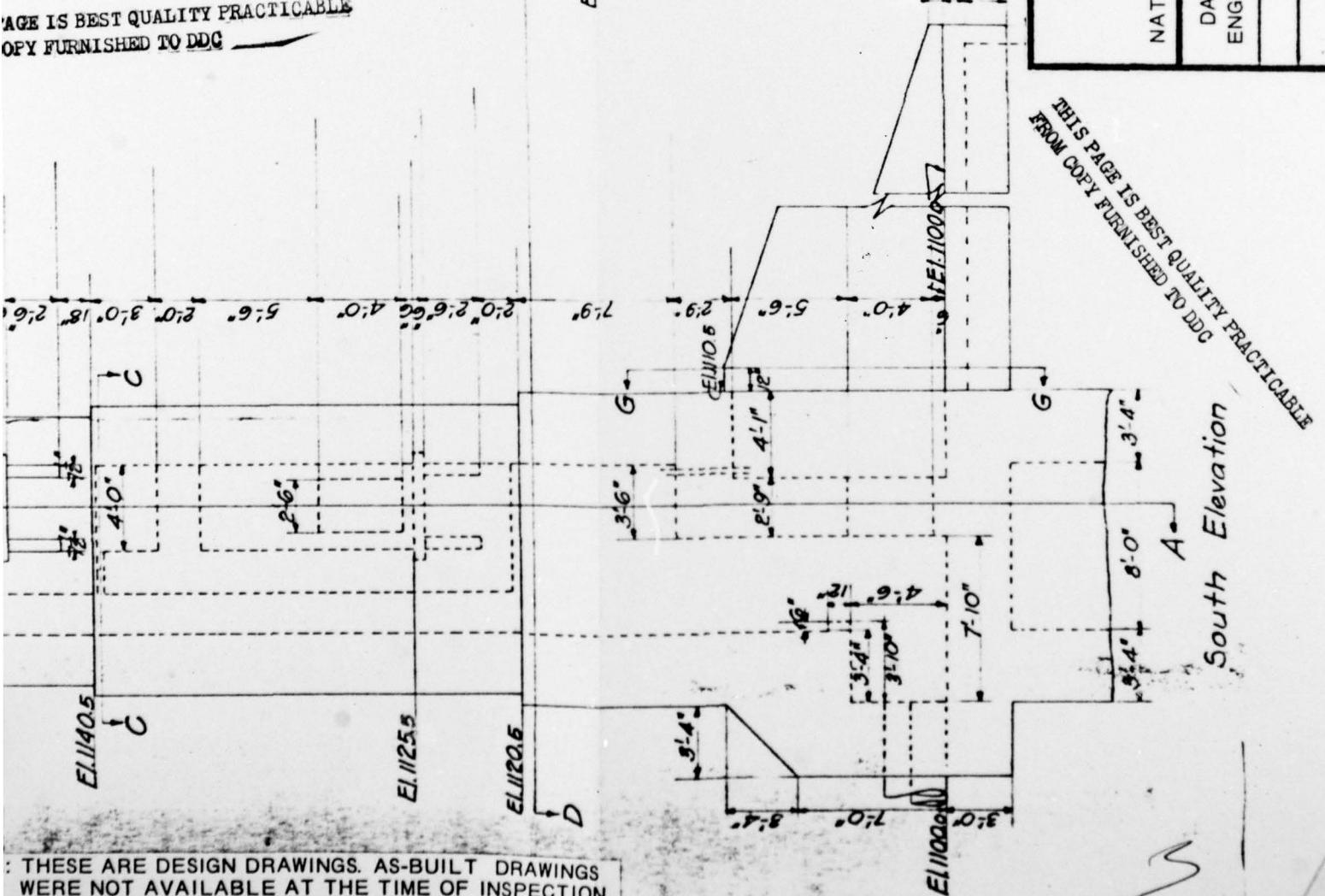
SECTIONS OF INTAKE TOWER
STILL CREEK DAM

NAT. ID NO. PA. 00700

SCHUYLKILL COUNTY

DATA OBTAINED FROM GANNETT, SEELEY & FLEMING
ENGINEERS DRAWING SHEET 6 OF 15, DATED APRIL 1924

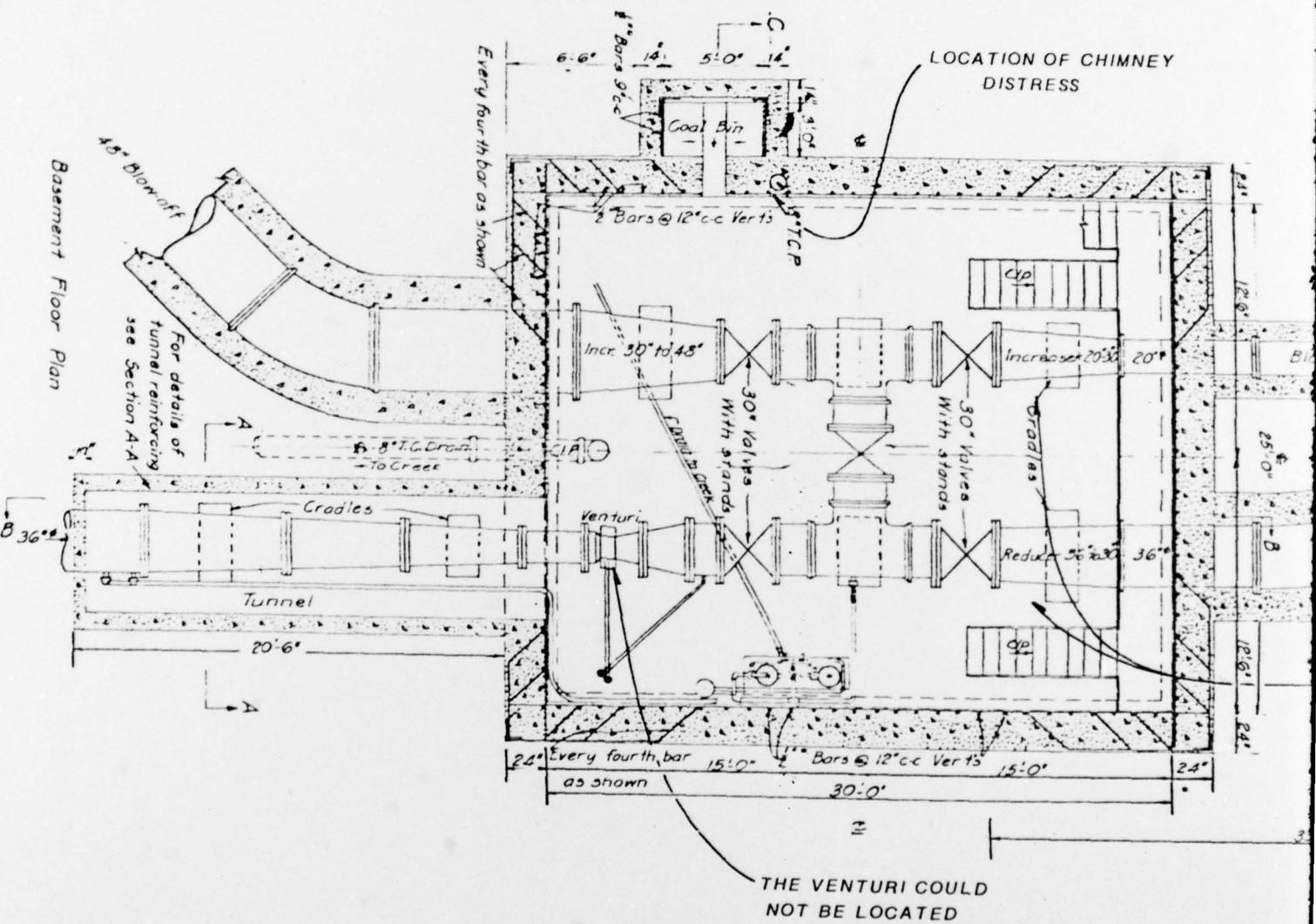
PLATE 5



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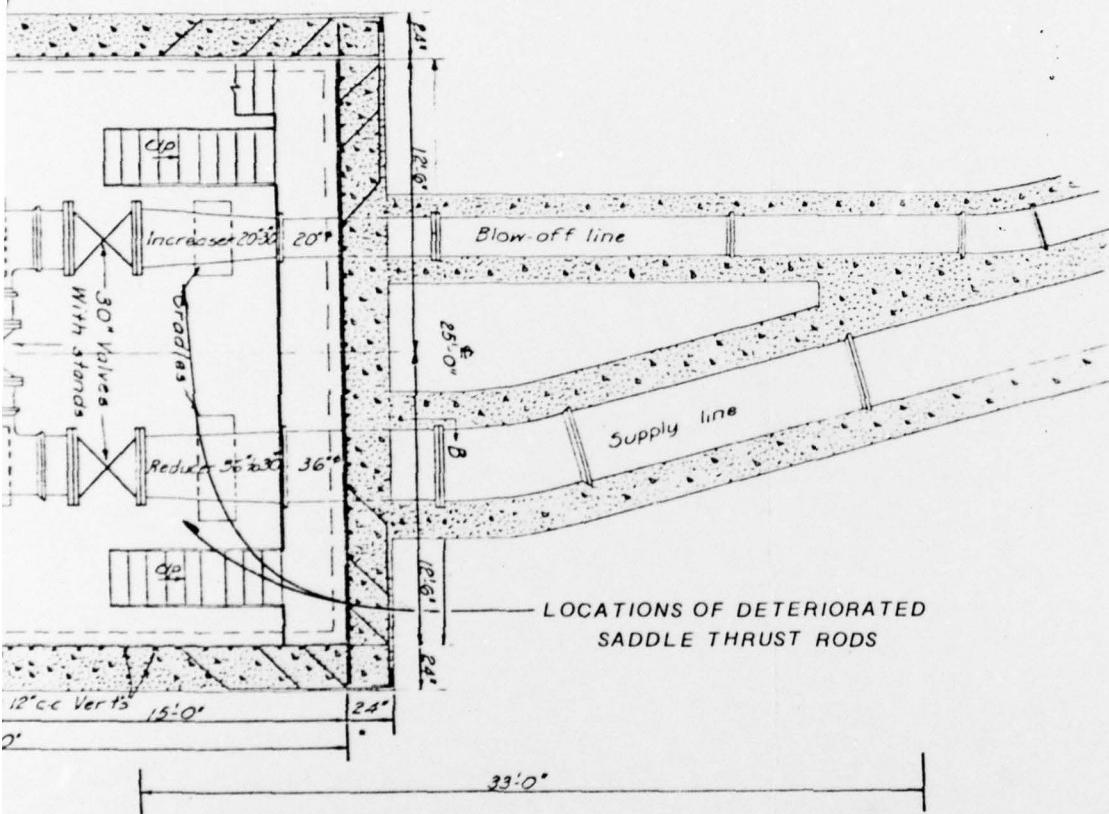
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LOCATION OF CHIMNEY
DISTRESS



URI COULD
OCATED

PUMPHOUSE FLOOR PLAN
STILL CREEK DAM

NAT. ID NO. PA. 00700

SCHUYLKILL COUNTY

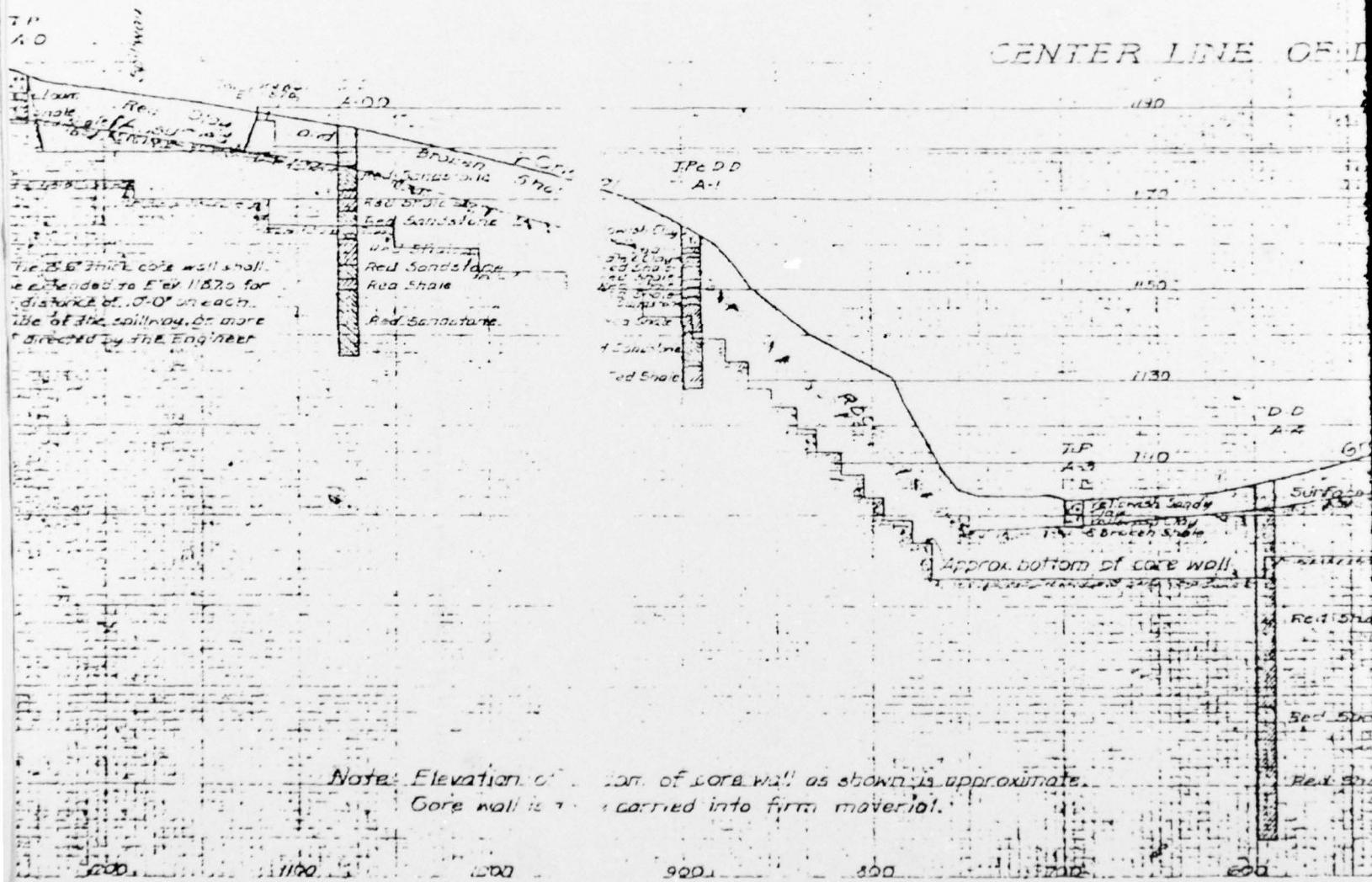
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ENGINEERS DRAWING SHEET 8 OF 15, DATED APRIL 1924

DESIGN DWG.
AS-BUILT NOT
AVAILABLE

PLATE 6

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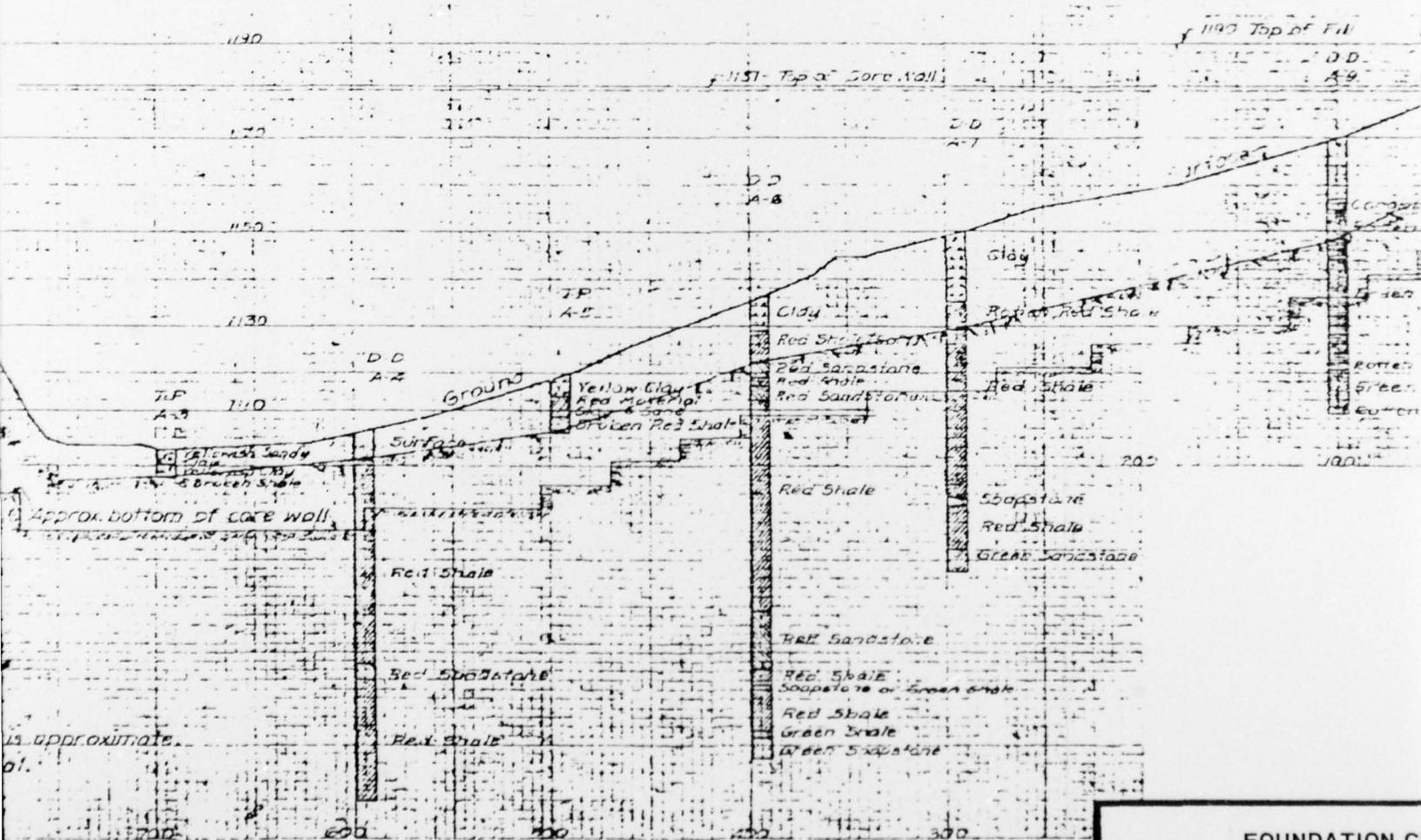


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CENTER LINE OF DAM



**FOUNDATION C
STILL**

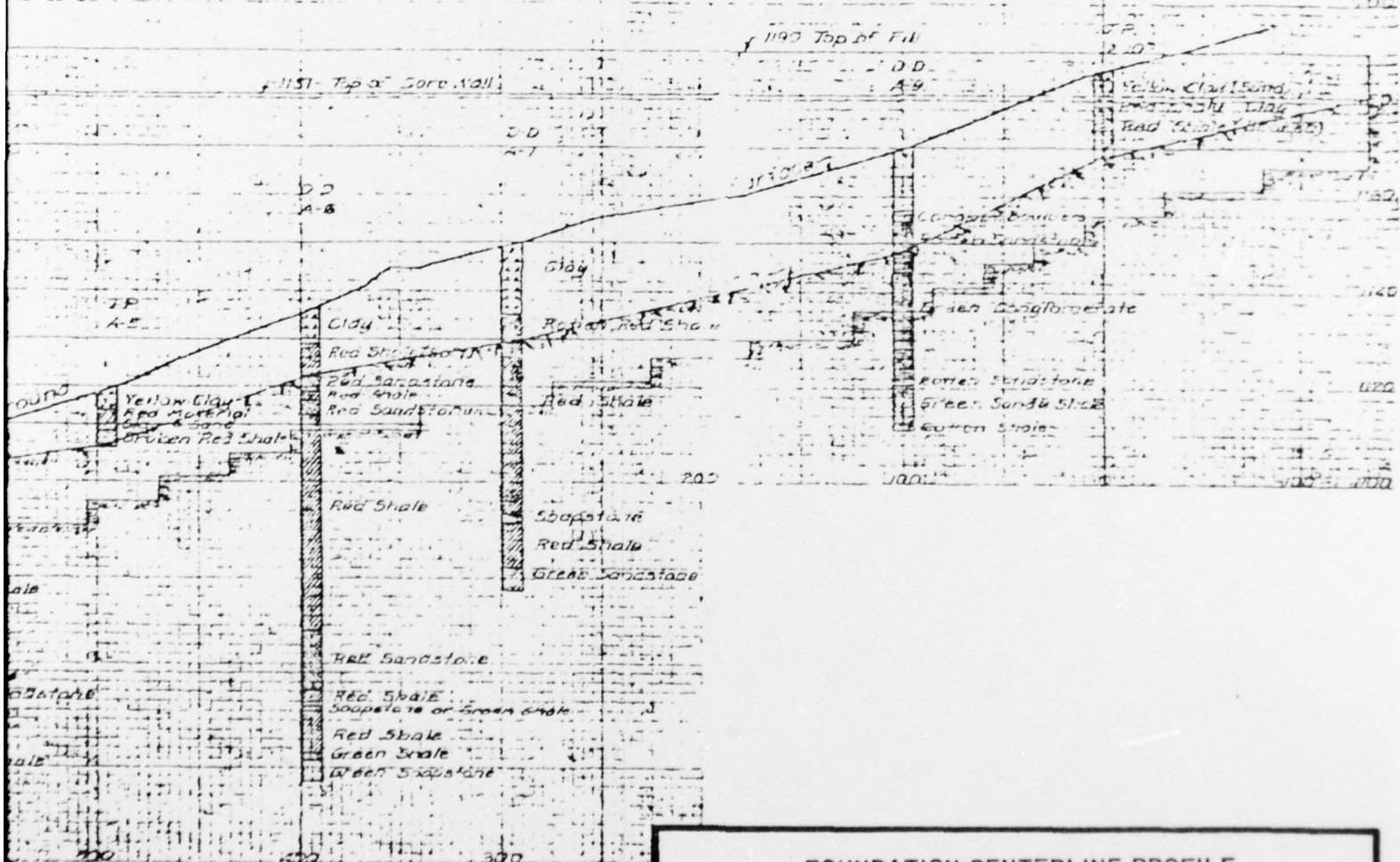
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DAM



**FOUNDATION CENTERLINE PROFILE
STILL CREEK DAM**

NAT. ID NO. PA. 00700

SCHUYLKILL COUNTY

DATA OBTAINED FROM GANNETT, SEELYE & FLEMING
ENGINEERS DRAWING SHEET 3 OF 15, DATED APRIL 1924

PLATE 7

APPENDIX

F

SITE GEOLOGY
STILL CREEK RESERVOIR

Still Creek Reservoir is located in the Appalachian Mountain Section of the Valley and Ridge Physiographic Province. As shown on Plate F-1, the dam is situated perpendicular to the axis of the Delano anticline and several regional thrust faults which trench northeast-southwest or near parallel with the reservoir shoreline. Rock types in the area consist of sandstone, siltstone, shale, and conglomerates of the Mauch Chunk and Pocono formations of Mississippian age. The dam is founded entirely in the Mauch Chunk formation having bedding which strikes north-northeast and dips to the southeast. Jointing in the area strikes northeast and northwest with northwest and northeast dips, respectively. The combination folded rock with northeast striking bedding and joints is conducive for water seepage downstream from the dam.

